The Chemical Age

A Weekly Journal Devoted to Industrial & Engineering Chemistry

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Contents

NOTICES:—All communications relating to editorial matter should be addressed to the Editor who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Other communications relating to advertisements or general matters should be addressed to the Manager.

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Industrial Efficiency and Fatigue

IN this week's issue we bring to a conclusion our special report of the meeting of the British Association at Bournemouth. In view of the host of information, of paramount interest to the industrial and scientific chemist, which was outpoured, we feel that no apology is necessary for the absence last week of some of our usual features. So far as the chemical and allied features of the meeting were concerned, we attempted to give an almost complete report, and in this direction we were greatly assisted by the fact that no official restraint was put upon us by the rules of the Association. This policy, it may be mentioned, is in marked contrast with the regulations of many other bodies of the kind, who fence round their proceedings with the stipulation that only abstracts of some wholly inadequate length must be given. We have ventured the opinion before that a policy of restriction probably defeats its own object, in that while it may be responsible for roping in a few new members, who join for the sake of the complete proceedings, it precludes the bodies concerned from reaping the advantages of a good deal of free publicity, as is instanced by the considerable amount of space which was given to last week's meeting by all the leading daily newspapers. It is to be trusted, therefore, that the "prohibitionists" will take the lesson to heart.

The latter portion of the Bournemouth meeting was given over largely to the discussion of economic questions, and the influence of the shorter working day upon industrial efficiency. Lord Leverhulme has suggested a scheme whereby (instead of the eight-hour shift) the workers would be put on two six-hour shifts each day, namely, from 7 a.m. to 1.30 p.m., and 1.30 p.m. to 8 p.m., with half-hour breaks for meals. In this way the machinery would be kept running for 72 hours per week, and, as the overhead charges on this account are often higher than the cost of wages, it would still be possible to pay the same wage for six hours as for eight hours, even if the rate of production showed no improvement. Under the Leverhulme scheme it is also proposed to add two hours per day of education and physical training. At the Bournemouth meeting Dr. H. M. Vernon quoted a number of instances in which production per human unit had actually increased when shorter hours were introduced, but the effect would appear to be decidedly variable, being influenced by the extent to which the work is dependent on the personal element and on machinery. The fact is that no general rule as to hours can be framed to cover the industries of the country as a whole, and what might be excellent in one trade would probably be disastrous in another. If a general rule is to be laid down it can only be to the effect that no worker should be permitted to labour for a period which results in physical exhaustion. There can be no question that the nature of the labour, and the conditions under which it is effected, vary considerably; and a miner has, perhaps, a justifiable excuse in demanding that his daily hours of toil shall be less than those, shall we say, of the man who merely watches and oils up a stationary engine. Hence, if we give the latter a six-hour day, then, in time, the miner will begin to draw up comparisons, and he will want a four-hour day—and so we shall go on. Dr. Vernon is of the opinion that in most industries the eight-hour day does not cause more than a moderate amount of fatigue, and that the desire of the workers to cut down their hours is the result rather of monotony and boredom. Perhaps Lord Leverhulme's two hours of education and physical exercise will add the necessary variety, but it is hard to shake the British working man out of his conventional groove, and unless a man has been brought up on the proposed system it is difficult to imagine him settling down to it in middle age or after.

U.S. Labour Demands Research

Although the United States has had its epidemic of unrest, it is encouraging to find that the more earnest and responsible leaders of labour out there are looking ahead of their day. The workman is not generally given to looking to the future, and is usually quite content to live from one day to another without devoting much thought to the succeeding generation. He realises that he has had to fight his battles for himself, and expects those who follow in his footsteps to look after their own welfare in the same way. When meeting recently at Atlantic City, however, the American Federation of Labour passed a resolution in which they called upon the United States Government to give adequate support to a broad programme of scientific and technical research. In a copy of the resolution sent to President Wilson it was pointed out that research and the technical applications of the results of it form a fundamental basis upon which the development of all forms of industry must rest. Productivity, in fact, is greatly increased by scientific development, and the gain in welfare of the nation is many times greater than the cost which is involved in investigation. An analogy is drawn between research in medicine and research in industry. Everyone is prepared to accept that the health of a nation is dependent upon advances in medicine; but it has yet to be appreciated that, from the point of view of the general welfare, advances in the science of industry are equally important. Increased productivity resulting from scientific research is a most potent factor in the ever-increasing struggle of the workers to raise their standard of living, and the importance of this factor must steadily expand, since there is a limit beyond which the average standard of living of the whole population cannot progress by the usual methods of readjustment. If this limit is to be raised it can only be done by the correct utilisation of the results of research in industry. The war has brought home to all nations the overwhelming importance of scientific investigation to national welfare, and although the benefits derived from a continuation of such research cannot, of course, operate immediately, their value will be recognised to the full in the future. Perhaps Germany, alone among nations, owed a great deal of her pre-war prosperity to the recognition of this principle, even though her mind dwelt on imperialistic aggrandisement rather than the general social welfare.

It is a source of gratification to find that, although labour in this country has not yet moved in the same direction as the United States Federation, the leaders of science and industry are fully alive to the subject. For instance, Sir William Pope spoke last week of the enormous amount of scientific work carried out during the war, and characterised the present demands for economy as meaning the absolute abolition of all that has been done during the past five years. Attention was called to the wholesale scrapping of the Munitions Inventions Department, which—in spite of a predilection for hiding its light under a bushel—has carried out some really important work, and would have given even a better account of itself had it been unfettered by the usual official interference. This Department, it is agreed, might well have been continued on a smaller scale; and it is to be trusted that a resolution (urging upon the Government the necessity for apportioning an adequate sum for research) which was passed by the Chemistry Section of the British Association will not be ignored in the usual manner.

The Nitrate Position

It cannot be said that the subject of nitrogen products, whether natural or synthetic, has been neglected of late. In fact, articles on the subject, both in the technical and daily press, can be numbered by the dozen. If the information which has appeared is collated, it gives the impression that there is a good deal of conflict in the ideas which have been expressed, and one is inclined to think that the chief concern of many of those who deal with the subject is that of filling the maximum of space with a minimum of accuracy. Although hackneyed, however, the subject is still of importance, and with the object of obtaining a reliable view of the outlook we have sought the views of authorities who are in a position to give the true facts, as far as it is possible to give them. We hope, within the next week or so, to publish a series of articles on the subject, and below we give some points from a short interview which was kindly accorded us by a City merchant who has made a long study of the Chilean industry. In addition, we have arranged for Dr. E. B. Maxted to write for us a series of articles on the latest phases of synthetic nitrogen production, and the prospects of this form of manufacture being seriously taken up over here.

Meanwhile, the current issue of the *Times Trade Supplement* contains a short but quite informative article, which brings out some more or less novel points in connection with the subject. The writer gives the opinion that an attempt is being made to establish the idea that to import Chilean nitrate is a bad policy on economic grounds. This may be accounted for by a desire to create a public opinion in favour of synthetic nitrogen, in order to simplify the task of raising the necesary capital from the public at a later date to take over the works put up by the Government.

It is pointed out, however, that whereas the value of nitrate shipments from Chile amounted in pre-war times to something rather more than a million pounds per annum, the shipment of all classes of goods from Great Britain to Chile reached a figure of well over £5,000,000. Moreover, a very large share of these goods, from their nature and the port of destination, were evidently intended for consumption in the Chilean nitrate trade, and the ability of Chile to pay for foreign imports is to so great an extent limited by her exports of nitrate, that virtually the whole of the Chilean foreign trade is a direct product of the nitrate industry. As an instance may be quoted the import by Chile of nitrate bags to the value of £600,000 per annum. In addition to visible exports, there is the item of "invisible exports," which, in the case of trade with Chile, is very considerable. British shipping has carried nitrate to the extent of over 1,000,000 tons per annum, with a freight value of at least £3,000,000. The banking and insurance operations connected with nitrate have been almost exclusively centred in London, and a very large share of the broking and mercantile profits have also accrued in London. In a word, while this country has purchased for domestic consumption about 110,000 tons of nitrate per annum, we have carried in our ships, and merchanted, the greater part of the total production of about 2½ million tons per

annum. On any method of calculation, therefore, the commercial advantages to the British Empire of the nitrate trade have been exceptionally great.

A fact which is often lost sight of is that the Chilean industry is directly benefitting other concerns, such as the railways, which it employs for transport, and these owe their existence very largely to British capital. The writer states that there is, accordingly, little foundation for the fact that for us to assist the nitrate business is merely of benefit to Chilean interests.

A City Man's Views on Nitrate

During the week a representative of The Chemical Age was fortunate enough to claim for a few minutes the attention of a well-known City business man, the name of whose firm is a household word in the fertiliser industry. In the course of his remarks, this authority mentioned "that as Germany produced the greater part of the high explosives she required from synthetic nitrogen, it was too frequently assumed that the Germans would be able to produce all the nitrogen they require within their own country. In fact, it might be argued that they would produce such an amount that they might be in a position to export large quantities in the form of nitrate of ammonia, sulphate of ammonia, or cyanamide. It is impossible at the present juncture to form an accurate picture as to the situation in Germany, as owing to the scarcity of coal, and to labour troubles, it may be that their production is very heavily reduced. If commercial sulphate of ammonia and nitrate are obtainable at anything like reasonable prices there will still be a large demand for these articles. If very large quantities of synthetic nitrogen are going to be produced, it remains to be seen whether the cost of production will permit of a considerable discount in value as against the value of the natural article. Towards the end of 1920 it should be possible to ascertain approximately what the market position is likely to be in all these various nitrogenous products. In the meantime the general opinion is that the natural article will always command a higher price, and will be more readily saleable."

Speaking of the future, our informant said that "when the market becomes more normal everything will depend on the relative costs of production. At the moment the nitrate of soda market is firm, and, although stocks on the coast of Chile are very heavy, very large contracts have recently been placed, and it now looks as if there might be some further improvement in values; also, as the freight market is also very strong, it is not thought that the prices in nitrate for the coming spring are likely to show any further reduction. On the contrary, everything points to rather higher prices, and it will, in fact, be no easy matter to get sufficient supplies to Europe in time for next season.

"As regards sulphate of ammonia, the production in this country is less than expected, owing to the serious coal strike in Yorkshire, and owing also to the restrictions in the consumption of gas. In America, no doubt, labour troubles will also have caused production to suffer; and whereas America has been exporting considerable quantities, it now remains to be seen whether they will have anything available for export for the next few months. The demand for nitrogenous fertilisers in America is expected to be on a largely increased scale for the coming season."

Labour-Saving in Chemical Works

It is somewhat remarkable that in this country our chemical works are but poorly equipped with labour-saving machinery. Such a state of affairs may possibly have arisen from the fact that in the past the industrial chemist has been too fully occupied to bother himself with apparatus, the construction and operation of which requires a knowledge of mechanical engineering principles; while, in many instances, the handling necessitated is of an intermittent nature. Thus the idea prevails that full value might not be obtained from the initial outlay on machinery. The argument, no doubt, was fairly sound in pre-war days when an ordinary manual labourer received about 7d. per hour, but with this type of labour showing an increase of some 125 per cent. the question assumes an entirely different complexion. The great merit of machinery is that it tends to increase very considerably the productivity per human unit, and by a simple calculation it is easy to arrive at the axiom that the saving of a single man's wages warrants, under present conditions, a capital outlay on mechanical plant of some £1,400. For instance, assuming that the average labourer now receives a gross wage bordering on £4 per week, the annual expenditure per man is £208. On the other hand, the annual expenditure on mechanical plant is represented by the charges for interest on capital, wear and tear, and depreciation, a total which amounts in all to 14 per cent., or £196 per annum. As the total of 14 per cent., however, includes 7 per cent. for depreciation, the machinery presents the additional advantage that each succeeding year the capital of £1,400 per man is written down by £98. In other words, as the plant wears out, and the capital is gradually recovered, the charge for interest is constantly decreasing.

Whereas, therefore, every works' manager would do well to examine his labour bill and see what saving could be effected by employing mechanical means, the other sides of the question must not be lost sight of. For instance, mechanical plant, while it may displace unskilled labour, invariably introduces a more highly-paid form of labour in the shape of skilled attendants and a wear and tear gang. For large installations the ratio of labour displaced to skilled labour introduced is so disproportionate that a wide margin of economy can be shown; but the smaller the capacity of the plant the nearer do the two items approach each other, and in the majority of chemical works small installations only are required. Again, too, it should be carefully considered whether or not the introduction of machinery would burden the management with any little responsibilities which cannot be gauged in terms of money. For instance, manual labour may be considered comparatively free from breakdown, even if in these capricious times it can scarcely be called reliable. We believe, however, that the short series of articles which Mr. Zimmer is contributing to our columns will prove immensely useful at this period of reconstruction and extension. Mr. Zimmer writes as an accepted authority, and is dealing with a branch of his subject upon which very little has been hitherto written. His articles, moreover, are timely, for we understand that the subject is shortly to be discussed by the Chemical Engineering Group of the Society of Chemical Industry.

Mechanical Handling of Chemical Materials

By George Frederick Zimmer, A.M.Inst.C.E.

In this, the third instalment of his article, the writer considers what is probably the most difficult part of his subject, namely, the handling of deliquescent substances. He also gives a number of examples where mechanical handling has been adopted in connection with such materials as nitre cake, sulphate of ammonia, sodium nitrate, &c.

III.

VI. *The Handling of Viscous and Deliquescent Materials and those in all stages of fluidity.*

For this class of material it is exceedingly difficult to provide mechanical appliances, particularly for the viscous materials, and it will often be better to handle these latter in receptacles either on gravity runways, slat conveyors, or swing tray elevators and conveyors. The receptacles must then be filled and emptied by hand, with the exception of the first. These types of elevators and conveyors are also suitable for raising loads vertically. The slat conveyor running at a shallower angle must, therefore, be rather long for a great lift, while the swing tray elevator lifts vertically and picks up or deposits its load automatically on any floor through which it passes. Deliquescent materials can well be handled on a flexible steel band conveyor, and if, owing to the acidity of the material, steel is objected to, a cotton band with a thick rubber covering, may serve, but probably the best, at all events the most frequently used conveyor for super-phosphates is the tray or continuous trough conveyor. It runs from 80 to 100 ft. per minute, and handles superphosphate of lime in all degrees of coarseness. Fig. 10

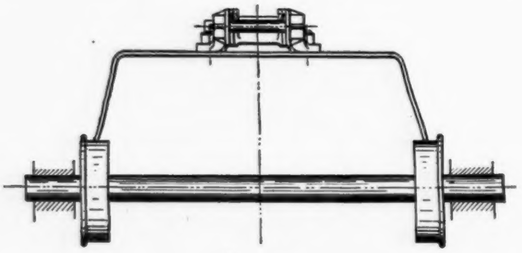


Fig. 10.

shows the best method of supporting the return trays on rollers, since the usual method of support, shown in fig. 11,

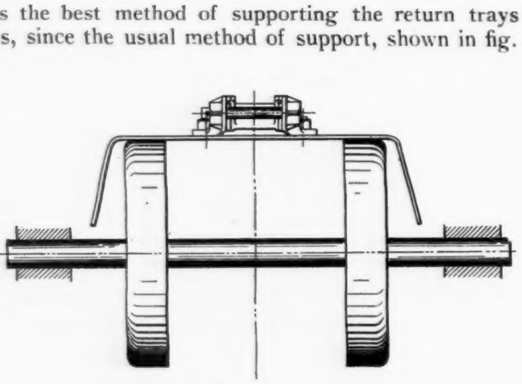


Fig. 11.

is unsuitable owing to the superphosphate sticking to the rollers.

The flexible steel belt is more particularly used for handling materials such as yeast, evaporated milk, beet pulp (see fig. 12), raw sugar, etc. When the material is

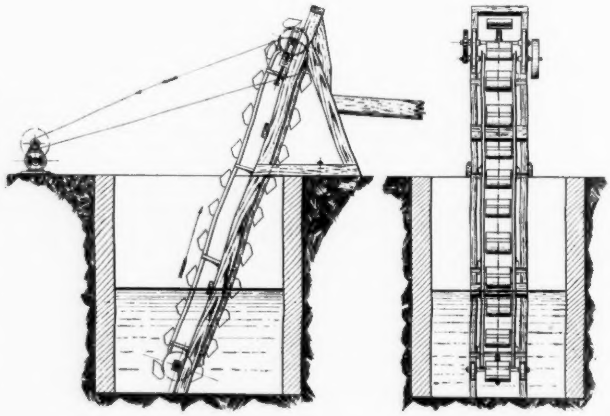


Fig. 12.

sufficiently liquid to be handled by gravity in open gutters or pipes, it will be best (provided pumps are not suitable) to use bucket elevators specially designed for this purpose, and to let the material travel by gravity to its destination. Special types of elevators have been designed for this purpose, and can be used for slurry and similar substances when hot (which latter a pump will not tackle), or where owing to impurities in the substance the valves of the pump will block. The more sluggish the substance the slower will such elevators have to be driven in order to give the necessary time to leave the bucket at the delivery point.

Guarantees of Efficiency

The proposition under Heading VI is undeniably difficult and in contracting with a handling engineer it is as well to stipulate for full guarantees as to efficiency. If the quantities to be handled are not sufficiently great to make a mechanical installation desirable it will sometimes be best to do the work by hand. Beneficial and economical as handling devices are in most instances they should not be dragged into use where they are not likely to be a permanent success. There are, however, many fluids which can be most successfully handled by such elevators. In the following Mr. W. H. Atherton, who has had great experience in sludge elevators, says there are few jobs more disagreeable than emptying the mud out of a sludge pit. Such liquids are of varying consistencies and the thinner they are the easier it is to deal with them by means of such elevators. When too torpid to flow into the buckets sludge cannot be so handled. A simple and successful form of inclined sludge elevator is shown in fig. 12. The elevator is 21 ft. from centre to centre and is fixed in a pit measuring 10 ft. by 8 ft. by 13 ft. deep. It was erected in a Lancashire bleach works by the Ewart Chainbelt Co., Ltd., of Derby. The speed of the elevator is 90 ft. per minute, and its capacity is 800 c.f. of sludge

per hour. The buckets are 18 inches long and are pitched at 24 inches. Fig. 13 shows one of the buckets, which are

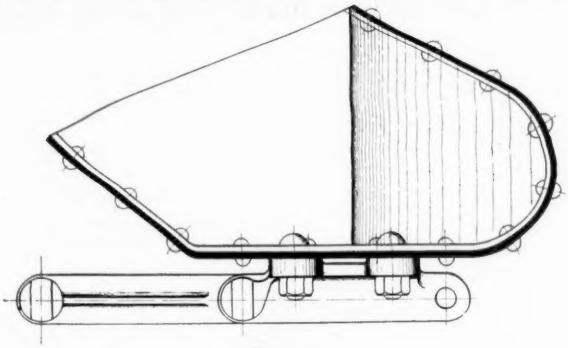


FIG. 13.

made watertight and galvanised, they are also provided with skidder bars which slide on angle iron guides and support the lifting and return strand. The main framing is of timber as well as the delivery shoot. The tension adjustment is at the upper terminal, the lower one being inaccessible. A back-geared motor of 2 h.p. is sufficient to drive this elevator by belt and single reduction spur gear.

An interesting example of a sludge elevator recently installed by the same engineers is illustrated in fig. 14. This is one of a group of four machines, each having a capacity of 2,400 cubic feet per hour, in this case the concrete sludge pits are 22 ft. deep and 20 ft. in diameter, having a capacity of 41,000 gallons. The elevator is fitted compactly into an inclined channel 5 ft. 6 in. wide, leading from the lowest point of the pit to the surface. The length of each of the elevators is 42 ft. between centres, they are fitted with buckets 24 in. long, and the working speed is 90 ft. per minute. They are similarly supported by skidder bars, which slide on angle iron guides on hard wood framing, the motor being of 10 h.p. The sludge is discharged from the buckets down a large steel shoot into a receiving hopper, from which it passes through a valve into a hinged shoot guiding the sludge into the buckets or tipping skips of a ropeway which transports it on to waste land some distance away.

Working Examples

A few typical examples may not be without interest before we proceed to the second part of the subject. An installation for handling nitre cake by means of a vertical dump elevator and two pushplate conveyors is shown in fig. 15 in

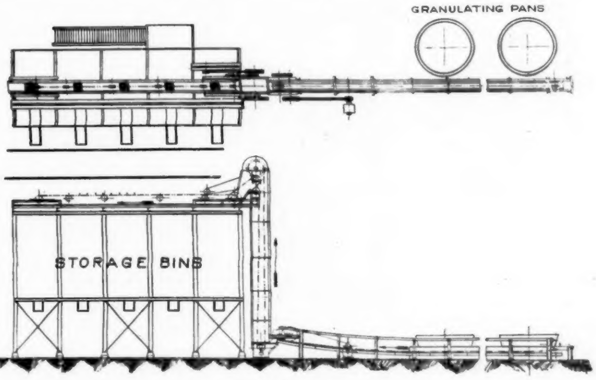


FIG. 15.

plan and elevation. The nitre cake is ground in granulating pans alongside of which passes a pushplate conveyor. The trough as well as the pushplates are of cast-iron as the crude bi-sulphate of soda attacks steel freely. The fully enclosed cast-iron bucket elevator receives the feed from the pushplate conveyor and delivers at its upper terminal into a similar conveyor running over the top of a battery of overhead timber bunkers. From these the contents are withdrawn by gravity, as required, into railway trucks. Similar installations are in use for ammonium nitrate and other chemical salts. Wood troughs and scrapers have been used for this purpose, but they are not satisfactory so far as their lasting qualities are concerned.

A general arrangement of a complete handling plant for

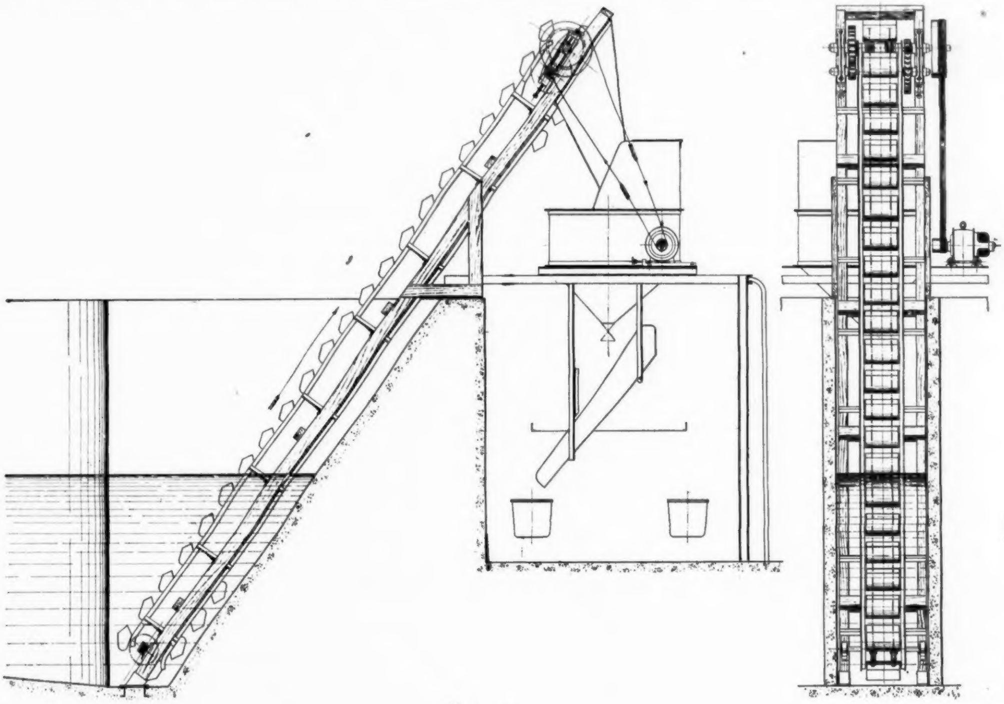


FIG. 14.

sulphate of ammonia in and out of store is shown in figs. 16 and 17. The hot sulphate from the centrifugal machines is

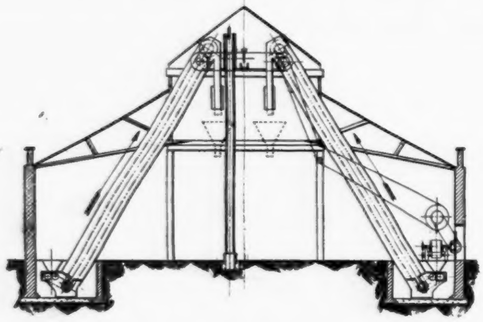


FIG. 16.

received by an ordinary inclined bucket elevator with 7 in. buckets, which raise it to the roof of the building and deliver into a push-plate conveyor which discharges all along into the store, forming a large heap. When during the spring the demand for sulphate of ammonia is great the content of the store is withdrawn, this operation is performed in two ways. In one store the sulphate is wheeled a short distance in barrows, or conveyed a greater distance by a band conveyor; in the other store, it is then tipped into a receiving hopper over crushing rollers, and passed into an inclined bucket elevator with 12 in. buckets and completely enclosed in wooden casing, which raises the sulphate of ammonia into a hopper from which it passes to an automatic weighing machine delivering 2 cwt. charges into bags. There are two such elevators which will be seen on cross section, fig. 16.

Pushplate conveyors for sulphate of ammonia were built of pitch pine in former days when timber was plentiful. The trough was then 2 in. thick, and the scrapers were of elm. At the East Greenwich Chemical Works of the South Metropolitan Gas Company there are several of these, which give great satisfaction, built by the Ewart Chainbelt Co., Ltd., of Derby. When conditions are again normal such troughs will probably be built of timber once more.

In a sodium chloride conveyor which is at work in this country, and which has a capacity of 25 tons per hour, the equipment consists of a troughed belt conveyor in a trench below the floor which traverses the length of the store. Above the band conveyor are two deflecting boards so arranged that at whatever part of the store salt is shovelled into this it must fall on the centre portion of the conveyor. At the delivery end of the band an inclined bucket elevator receives the salt and raises it into railway trucks which stand on a weighbridge; the length of the conveyor is 130 ft. between centres, and it is 16 in. wide; the elevator is 18 ft. between centres.

T.N.T. Conveyors

A typical band conveyor installation for handling T.N.T. is that which was built by the Hepburn Conveyor Co., of Wakefield, for one of the explosive factories in the north. The installation consists essentially of two 18 in. band conveyors arranged tandem fashion, the T.N.T., after solidifying in vats, is broken into pieces and shovelled on to the horizontal portion of the conveyor, running at a moderate speed. The shorter inclined portion conveys the material upward and forward into a crusher where the large pieces are cracked to uniform size. The conveyor trough is made of birch; the rest of the woodwork is pine. The belt is of solid woven cotton and runs in a slightly guttered trough, the return strand being supported by rollers.

In an installation which is used for handling deliquescent material at the rate of 30 tons per hour, the conveyor is hung from the ceiling, and above it stands a battery of extractors so that the material passes from these down through wooden shoots on to the conveyor. The conveyor belt is of the composite rubber-cotton type and the loaded side is supported by troughing idlers, while the return strand is supported by flat idlers.

Another example which may be quoted is an installation for handling fine powdered sodium nitrate. It consists of an elevator, fed from two dryers, which discharges into a covered overhead storage bunker from which the material is withdrawn, weighed, and transported to the retort benches. The whole apparatus is dust-tight, and the elevator is of the chain type with seamless, pressed steel buckets, 18 in. apart. A 3 h.p. motor drives the elevator by worm and worm gearing.

Morocco Phosphate Deposits for Tender

THE British Vice-Consul of Morocco (French Zone) announces that the phosphate mines at El Boroudj will probably be put up to public tender early next year. Firms wishing to tender will have at least five months' warning of the call for tenders, "cahiers des charges" being published, and all possible information given to enable them to make out their offers. Competition will be open, and the concession will go to the tenderer who offers the highest amount per ton exported from the Protectorate. The concession is not one which would interest small companies, as it is expected that it will call for Fcs. 100,000,000 capital. Railways of at least one metre gauge will have to be constructed by the concessionaires, and it will be probably a matter of two years before any mineral is exported. It is not yet certain which part of the district in which the deposits are found will be first put up to tender, whether the N.E. end, near Oued Zem, or the S.W. end, near El Boroudj. A well-known French company is already at work preparing for the tender. The concession is a large concern, and the Protectorate desire to eliminate small companies who will not put the matter properly in hand. They will welcome British or any capital likely to be able to work the deposits in a large way. Analyses of the deposits already explored, and a map of the district, together with railway and shipping considerations, may be obtained by British interests on application to the Near East Section, Department of Overseas Trade, 4, Queen Anne's Gate Buildings, Westminster, S.W. 1.

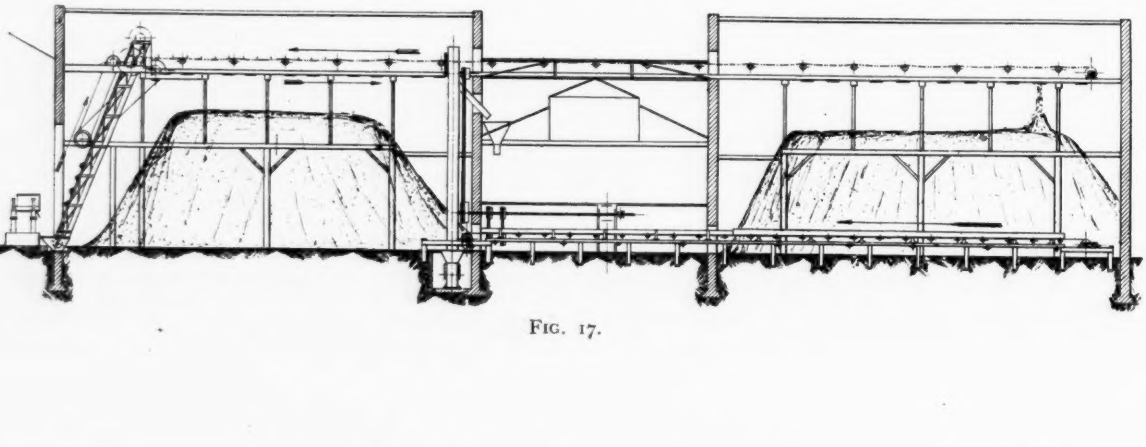


FIG. 17.

The British Association

Concluding Days of the Meeting

The British Association meeting came to a conclusion on Saturday last. In our issue for last week we reported the proceedings up to the end of the second day, and we now complete our report of those papers, etc., which directly concerned the chemical industry.

The Holton Heath Cordite Factory

On two occasions during the meetings of the Association, the Royal Naval Cordite Factory at Holton Heath, between Poole and Wareham, was thrown open for inspection. The first was on Thursday, September 11, when the members of the Chemical Section paid a visit, and the second was on the following afternoon, when the same privilege was extended to the members of the Engineering Section.

The factory is laid out on a circular plan, the point of entry being the acid department, to which the railway is brought. A brief indication of the processes is that in the acids department sulphuric is manufactured by the contact process, nitric acid by a modified silica coil system, sulphuric acid by the Kessler system, and sulphuric acid from condensation is carried out by the Cottrell electrostatic precipitation plant. Next came the guncotton department, in which cotton-bale breaking, teasing and drying was seen, as well as nitration by the displacement process. A form of half-manufactured cotton has been used instead of cotton waste, and this, necessarily, has forced up the cost of manufacture; but at Holton Heath those responsible are convinced that this makes for greater safety, and the fact that there has been no explosion there affords some justification for the view. The engineering department came next, but the chemists did not spend much time there. The department, however, is of considerable dimensions, as will be gathered from the fact that there are twenty-four boilers, and that the generating plant contains some large Brush-Parsons turbo-alternators. The plant in the acetone department, which is laid out for the manufacture of acetone and butyl alcohol by a fermentation process from maize, rice, etc., was not in operation, but it may yet find useful application in connection with the ingenious idea of Dr. Thaysen, the resident bacteriologist to the factory, who is convinced that power alcohol can be produced from mangolds, at about 1s. 8d. a gallon, on the basis of 24 tons of mangolds per acre, yielding 240 tons of 95 per cent. power alcohol, or 11¾d. per gallon of the yield, as he believes could be increased to 40 tons. A residue in the form of cattle cake would remain. These views are based on the results of experiments carried out on reclaimed land adjoining the factory and by neighbouring farmers. Thus, the six fermentation tanks, each having a capacity of 150,000 gallons, would find a useful occupation. Acetone, during the war, was made from damaged rice. The tetryl nitration and the tetryl purification plants were not in operation, but in the acetone recovery department the company was shown the way in which acetone is recovered by the cordite stoves by the bisulphite process. Next came the cordite department, where the operations of handling the finished product were seen. Full provision is made in the factory on the welfare side. The factory occupies an area of 500 acres, lying on heath land, and although possession of the land was not acquired by the Admiralty until April, 1915, manufacture was in full swing by the following December. The war output of the factory was, on an average, 150 tons of cordite per week, but at present it is only about 50 tons.

Bacteriology Outside Medicine

By Dr. A. C. Thayson

Since the days of Pasteur, Robert Kock, and Lester, bacteriology has been recognised as a special branch of science devoted to the study of the microscopic unicellular organisms commonly known as bacteria. However, in spite of official recognition, bacteriology is by no means yet an independent science. It still remains allocated to quite a number of arts and sciences with which it was associated in its earlier history, and it is still taught and studied in relation to them. There can be no doubt, that sooner or later an attempt will have to be made to co-ordinate the various branches of bacteriology already existing, and to centralise and standardise the teaching of this science. In the hope of being able to increase in some small degree the interest taken in these other branches of bacteriology, a brief account is given of some of the various spheres of activity of the non-pathogenic bacteria.

The Conversion of Sugar into Ethyl-Alcohol

By far the best known application of micro-organisms to industry is the conversion of sugar into ethyl-alcohol, mostly in the form of wines and beer. The brewing of beer and the making of wines are industries as old as history itself, but it is only within the last 30 years that they and the responsible micro-organisms have been brought under scientific control. Much work, both theoretical and practical, is still needed in this field, which to-day has attained added interest through the application of yeast for the manufacture of glycerine and fuel for internal combustion engines. Closely related, both industrially and historically, to the production of beer and wine is vinegar manufacture. Here the conversion is brought about by a true schizomycet, which oxidises ethyl-alcohol to the corresponding aldehyde, and thence to acetic acid, or in the presence of oxygen, to carbon dioxide. Pasteur, Hansen, Buchner and Brown's subsequent researches have cleared the way to the right interpretation of this reaction, but unfortunately the actual manufacture of vinegar is still far from satisfactory. Far too little attention is being paid to the value of the introduction of pure cultures and the consequent improvement in the control of the degree of oxidation. As a side issue, it would be of interest to investigate further the property of some of the acetic bacteria to oxidise higher alcohols; for instance, butyl-alcohol, to the corresponding acids. It might perhaps in this way be possible to manufacture butyric acid at a lower price than by chemical oxidation of butyl-alcohol or by direct fermentation of carbohydrates.

The Manufacture of Butyl-Alcohol and Acetone

The manufacture of butyl-alcohol and acetone attracted considerable attention both in this country and abroad during the war. The enormous demand for one of the products obtained necessitated the construction of gigantic plants. In a factory erected by the Admiralty for the production of acetone, a weekly output of this chemical of 30 tons was planned. The fermentation tanks had a capacity of 150,000 gallons each, making it possible to convert 35 tons of new material during one fermentation. The conversion of the carbohydrates used, took 34 to 36 hours to complete, so that with two fermentations proceeding simultaneously, two tons of raw material could be dealt with hourly. For the successful conversion of the carbohydrate it was essential that foreign micro-organisms should not gain access to the vats, either before or during the fermentation, a somewhat difficult problem to solve on such an immense scale. Eventually success was met with, and from that time onward the conversion of the carbohydrates into acetone could be most successfully completed, and considerably more than 99 per cent of all the fermentations were free from serious infections with foreign bacteria.

An Interesting Discovery

The investigation of the theory of this fermentation led to a rather interesting discovery. On examining the fermenting liquid it was found that appreciable qauntities of acetic acid were formed as an intermediate product, and again mostly disappeared toward the end of the fermentation. On increasing the acid content of the fermenting liquid by the addition of

acetic acid in concentrated or dilute form, it was found that 80 per cent. of the acid added had been converted into acetone at the end of the fermentation. A far more efficient method than the old dry distillation of calcium acetate had thus been found for the conversion of acetic acid into acetone. The addition of acetic acidon a large scale, up to 100,000 gallons of fermenting liquid, has been tried and found as successful as the laboratory. Other fermentations, which might be technically applied, were the conversion of carbohydrates into lactic acid and the production of citric acid.

Further Branches of Bacteriology

Reference was also made to the manufacture of intoxicating drinks, other than wines and beer, whilst a further industry, based on the application of bacteriology, is dairying. By far the most important branch of bacteriology is that which treats of the micro-organisms of the soil, and among others are the modern disposal of sewage, the retting of flax, the maturing and development of flavour in coffee, cocoa and tobacco, and in the tanning industry; whilst, finally, in the cotton industry various soil organisms are found to be highly important. It is not here a question of the improvement of the cotton through the action of bacteria, but of serious damage. From the moment the boll opens, the ripening cotton is exposed to contamination, which generally increases during the harvesting and subsequent treatment of the cotton. The examination of this contamination was recently begun at the Naval Cordite Factory, and points promising to be of considerable interest, had already been brought to light.

Time after time, in reviewing the development of bacteriology, there is evidence of lack of co-ordination which for far too long had been allowed to exist, and which, unless treated seriously, is liable to remain one of the greatest obstacles to progress.

The British Glass Industry

Discussion on Dr. Travers' Paper

In our issue for last week we gave an abstract of Dr. M. W. Travers' paper, but the discussion thereon did not reach us in time for publication.

Sir Robert Hadfield, F.R.S., said he was interested in this paper because he was particularly anxious to know where it was possible to obtain the best glass for lenses in connection with micro study. He was informed that at the present time we were still dependent upon German and Austrian lenses if the very best quality was to be used. He had hoped the war had put that subject in a different position, and he was, therefore, very sorry indeed to find his experts telling him that we still had to go abroad to obtain the best lenses for the purpose he had mentioned. At the present time he was engaged in the study of magnifications up to five or six thousand power, and in that work the very best lenses were required. He was sorry to say that the best lens in his own works' research laboratory was one of foreign make, and whilst he was anxious to give every encouragement to British makers, a report upon the work of British lenses was to the effect that photo-micros obtained with them were not equal to those obtained with the foreign lens. He hoped, therefore, that every effort would be made to render this country independent of foreign lenses for the purpose in question. A few months hence the Faraday Society would be holding a symposium on the question of the improvement of our knowledge of the microscope and its applications. He was afraid that he had suggested that from a selfish point of view, because he hoped to benefit from it in his own special line of work; but, of course, any improvement would also be applicable to other lines of work. For that reason, therefore, he hoped that anyone who could contribute to the symposium by the Faraday Society would send them in to the Secretary of that Society. The meeting would be held some time in December. He had already got a promise of a contribution by Dr. Desch, and also the cordial co-operation of the Royal Microscopical Society and the Optical Society.

Mr. W. S. Chalmers said the most important difficulty in the manufacture of British lenses was the computation. Another difficulty was the supply of good transparent fluorspar, which was an essential constituent of most of the best and high class lenses. That would materially assist our manufacturers. He believed that British manufacturers were now at work in directions which were not possible before the war, and even during the war, and provided there was sufficient demand for their products to justify the expenditure of the necessary large sums of money on plant, the British manufacturer could produce as good an objective as the foreigner, as had been the case during the war, when very large sums were so spent.

Professor C. H. Desch agreed with Sir Robert Hadfield that there had been no comparison between British and foreign objectives hitherto. His experience had been exactly that of Sir Robert Hadfield, but he would like to point out that in certain classes of optical work we had led the world. The range-finder was an instrument which was perfected in this country, and had been manufactured here during the war. The optical work involved in the latest pattern of range finder, including the 30 ft. naval instrument, surpassed anything done in the works of Zeiss or Goerz. The degree of accuracy in these wonderful prisms had never been touched by the German firms, and the British firm which now manufactured them was responsible for its own optical glass, which was the finest he had ever seen. The factory, for military reasons, had not been open to visitors, but it was a wonderful example of organisation, both with regard to the manufacture of glass and the optical work. If we could have the same standard of skill reached in the manufacture of lenses, he did not think it would be long before British lenses would be equal to the foreign ones. The computation, as Mr. Chalmers had said, was perhaps the most difficult part of the work, but a tremendous amount had been done in that direction, and certain publications—mostly translations from German works—recently made, would greatly facilitate work on all kinds of objectives in the future.

An Ammunition Chemist in the Field

At the signing of the Armistice there were four factories in France where ammunition, considered to be unserviceable, was dealt with. The decision to build these factories was come to as the result of the services of chemists, it having been found that a vast quantity of ammunition was being discarded when very little attention would make it quite usable again.

In a short note on the work of an ammunition chemist in the field, Major E. R. Thomas referred incidentally to the erection of these factories, and mentioned one of the circumstances which led to the adoption of this policy. A large quantity of smoke ammunition was ordered to be destroyed, but owing to difficulties of transport for dropping it in the Channel, and the inability to make the munitions burn, the ammunition officer made experiments with a view to recovering something from it. With the aid of a 30-gallon farm boiler, he recovered tar and potassium nitrate, and working on a somewhat larger scale, but in extremely small units, a plant giving half a ton of tar and a ton of potassium nitrate was devised. The tar was mixed with sand and used as a substitute for timber for floors in convalescent camps and other places, and the potassium nitrate was disposed of. Following on these results, a central ammunition repairing factory was decided upon, but enemy movements prevented that scheme being put into effect. The four factories referred to were erected later.

Geo-Chemistry during the War

Speaking upon the subject of "Some Geo-chemical Problems dealt with during the War," Professor P. G. Boswell said that the question as to the exact scope of the subject of geo-chemistry was a debatable one. A well-known American authority had expressed his view of the functions of the geo-chemist thus: "To determine what changes (in the rocks constituting the earth's crust) are possible, how and when they occur, to observe the phenomena which attend them, and to note their final results. . . ." In the course of pleas made recently for the establishment of a Geo-chemical Institute in this country, the connotation has been extended to include not only the chemical investigation which was required before problems like those outlined could be solved, but also chemical research dealing with and controlling the industrial uses to which rocks and minerals may be put. As would be expected, the industrial application of our knowledge of geological raw materials had been the outcome of pure scientific research. On the other hand, in the course of the solution of practical problems much information of real value to the man of "pure" science had accumulated, and in due time the results would become available. One outcome of these extended geo-chemical investigations had been the replacement of certain rock and mineral substances hitherto

imported from abroad by British materials—either precisely similar in character, or as substitutes "just as good," at times distinctly better, and at other times of the character of make-shifts. Not only was shipping thus relieved, or, in the case of certain substances of enemy origin, deprivation overcome, but at the time of the great strain upon internal means of communication and transport, it was found possible to indicate suitable sources of raw materials close to works requiring them. In this way carriage was reduced, and coastal trade and railway transport diverted into less congested areas.

Lack of Raw and Semi-Manufactured Materials

Shortly after the outbreak of hostilities many British industries connected with the output of munitions or the maintenance and increase of food supplies, found themselves wholly or in part deprived of certain essential raw or semi-manufactured materials of mineral origin. Examples were the key industries of glass-making and steel manufacture (in particular, steel-founding) which suffered from the shortage of potash, glass-sands, moulding-sands, &c., besides other chemical materials made from mineral products. In connection with food supply, the lack of nitrates, potash-salts, and phosphates became acute. The chemists solved the nitrate difficulty by the fixation of atmospheric nitrogen. The investigation by the geologists and mining engineers of home supplies of potash-bearing minerals, such as felspar, and the recovery by the chemist, in co-operation with the geologist, of potash from blast-furnace flues in Britain and cement-kiln flues in America, temporarily overcame the difficulties produced by the absence of German salts. The coprolite-bearing deposits of the Cambridge greensand were after some delay, opened up for the purpose of obtaining the contained phosphate of lime, and at the date of the armistice were yielding helpful supplies.

The impetus given to the working of home supplies of metallic minerals, such as the ores of iron, copper, lead, zinc, tin and tungsten, and of veinstones like barytes, fluorspar and quartz, were familiar. The treatment of the ores and the manufacture of intermediate products like ferro-tungsten, demanded the co-operation of the metallurgical chemist.

It would, perhaps, be impossible in a paper of this length to give a list of all the mineral and rock substances, from antimonite, used for fulminate composition for percussion detonating, to zirconia, required for refractory and alloy purposes, which have been indispensable for the successful prosecution of the war.

From a perusal of the publications issued during the war by the Geological Survey (Special Reports on Mineral Resources), the Ministry of Munitions (Department of Scientific and Industrial Research), and the Imperial Institute, some conception may be obtained of the increased attention which has belatedly been paid to economic geology at home. In the publications of certain Technological Societies, such as the Faraday Society, the Ceramic Society, the Society of Glass Technology, and the Foundrymen's Association, Institute of Mining and Metallurgy, the Society of Engineers, may be found even more useful information regarding the treatment and behaviour as well as the resources, of materials like fireclay, gannister, zirconia, felspars, moulding-sands, glass-sands, &c. The manufacture of silica-bricks, magnesite and dolomite bricks, fireclay bricks and blocks, glass-house pots, glass itself, &c., and their behaviour in the furnace at high temperatures, provide interesting parallels with the phenomena shown by rocks which suffer transformation in or below the earth's crust. G. V. Wilson has shown, for example, that the erosion of a glass-house pot by the molten glass contained in it was reduced appreciably by the formation in quantity of the mineral sillimanite in the surface layers of the pot. It had also been discovered that holes were originated where small pellets of the impurity—iron pyrites—occurred in the walls. Geo chemical research had shown that the quality of silica-bricks made by burning at a temperature of over 1,300 deg. C.—a ground-up mixture of gannister and other siliceous rocks, with 1 per cent. of milk of lime as a bond—might be appreciably improved by burning the bricks for a longer period at a higher temperature than was previously the practice. Greater inversion of the quartz to other low density forms of silica occurring occasionally in rocks, and known as tridymite and cristobalite, was thus ensured, with the consequence that less expansion of the brick subsequently occurred when it was set in the furnace.

The Need for Geo-chemical Research

For the successful laying down of specifications of refractory materials for particular purposes, a large amount of geo-chemical research was, and is still, required. Cognate problems were met with in the production of laboratory porcelain, hard paste, &c. In the Potteries, British felspar, sand, and flint were substituted for the unobtainable foreign supplies.

The increased steel production (especially "basic" steel) necessitated by the war, led to big demands for basic linings for steel furnaces. In consequence of the cutting off of supplies of Austrian and Greek magnesite the home resources of dolomite (Ca, $Mg.CO_3$) have been largely drawn upon, with noteworthy success. A similar artificial Empire product of dolomite, silica, iron oxide, &c., had been prepared in the American cement-kilns, and sold under trade names, such as cinderslag, magdalite, &c. For lining acid-open-hearth steel furnaces, large quantities of high silica sands were formerly imported from Continental countries. These have now been replaced by eminently suitable British supplies from Leighton Buzzard, Lynn, Huttons Ambo (York), and many other localities. The sand was of necessity required to be highly refractory to heat, and yet to contain sufficient impurities (in the shape of compounds of alumina, lime, magnesia, &c.), and to be of such size of grain that it would just "frit" and bind together on the sides of the bath, when the furnace bottom was being repaired. Sands of medium to coarse grade containing 98 or 99 per cent. silica, with an almost entire absence of alkalis, proved to be most suitable.

Very pure sands were also much in demand for the manufacture of the better-class types of glassware. These, too, were formerly imported from France, Holland and Belgium. In order that as little of the "decoloriser" as possible might be used, all glass-making materials, particularly raw substances like felspar and sand, should be as free from iron as possible. The silica percentage of good glass sands was usually 98 or 99, alkalis and alkaline earths were not harmful, but iron, estimated as ferric oxide, should not, for lighting glass and pressed ware, exceed 0.08 per cent., and for optical glass 0.02 per cent. The presence of alumina was an advantage in glasses where toughness and absence from devitrification are required.

Sands for Founding Metals and Alloys

Perhaps the most difficult, as well as the most interesting problems were those concerned with the use of sands for founding metals and alloys, particularly steel. Sands of very special character and behaviour were formerly imported from France and Belgium. The examination and analysis of these sands led to the exploitation of many British supplies. A high-class steel-moulding sand should be refractory to heat and, therefore must contain a minimum quantity of alkalis and alkaline earths, and a maximum of silica. It must also strip freely from the castings made in it, and therefore should possess a moderate quantity of hydrated ferric oxide. It should possess a good bond in order that it would stand up against the molten metal; the bond was usually a mixture of clayey and micaceous material, together with hydrated ferric oxide, and was colloidal in character. By virtue of the last constituent, the sands were able to take up a good proportion of water without becoming really wet, and after dehydration by the hot metal poured into the mould, could readily be hydrated again.

New lines of enquiry are opened up by the consideration of the production synthetically of moulding sands from an admixture of a high-silica sand, and small quantities of fireclay and colloidal hydroxides like those of aluminium, iron, or even cerium and zirconium, since the compounds of the two last named elements would be required only in very small amounts. Further, it is found that the texture of moulding sands is of considerable importance. The mechanical composition is characterised by the high proportion of coarse and medium sand grades (diameter of grains greater than 0.25 mm), the low proportion or absence of the fine sand and silt grades (0.25 mm. to 0.01 mm.), the fine relatively high proportion of the clay grade (less than 0.01 mm). Chemical analysis of these various grades which have been separated by elutriation yield results of much value in steel-founding practice.

A danger existed that in consequence of the cheapness of foreign supplies of raw mineral materials and of the lowness of the through freight-rates from adjacent Continental countries, it might be impossible to continue to work British supplies of

these materials. It was the energetic exploitation of these mineral resources, so essential for key industries, which saved the situation time after time during the war. A renewal of dependence upon foreign resources was not only grossly unfair to those who had laid down plant and sunk their capital in British mineral enterprises during the last four years, but was a source of grave national danger, inasmuch as it placed the country in precisely the same position as that which arose during the early months of the war. If it were not possible to impose restrictions on the importation of certain foreign raw materials recourse must be had to the revision of railway freights and the rapid development of internal water transport.

Discussion on the Fuel Economy Report

MR. MOND, in presenting the report in the absence of the Chairman of the Committee, Professor W. A. Bone, F.R.S., said that copies of the Committee's first report were laid before the Fuel Research Board in the hope that some of the recommendations made in that report would be carried out. The Board, however, had done nothing to carry out a systematic research upon all coals in this country in the same way that had been done in America. If all the coals in this country were analysed and classified it would be possible to put them to their best uses. One large chemical firm, with which he was connected, tested and classified all the coals they used, and the results were given to the Government, and had been found extremely useful, but that was not the way to deal with this problem. Being anxious that there should be a survey of the coalfields of this country, the Committee had approached the Fuel Research Board with a view to a certain sum being set aside for this purpose as it was beyond the means of the Committee to do this work. The British Association Committee, said Mr. Mond, had not, in the present report devoted much attention to artificial fuel; that would be dealt with in the next report.

SIR ROBERT HADFIELD, F.R.S., said that the Iron and Steel Institute intended to devote a whole day to the discussion of fuel economy at its autumn meeting, and a Committee of the Federation of British Industries would shortly be reporting upon the matter. There was no doubt that this country had been very wasteful in the use of fuel in the past, but it did not apply to this country only. In America the waste was prodigious, and steps would have to be taken there also to deal with the problem. Indeed, a report would shortly be issued by the Mineral Resources Bureau of Washington. On this important matter they should pool their knowledge and researches; moreover, it was time that the Fuel Research Board threw a little light on the work it was doing.

MR. C. E. STROMEYER said that some very wild statements had been made as to the consumption of coal in this country per indicated horse-power. He believed that a Cabinet Minister had stated that it was 7 lbs. The actual figures, however, were about 2½ or 3 lbs. In some cases it was more like 2 lbs., and it was from statements of this kind that he believed the country had been mislead into hoping to get far greater economies from power schemes than they were likely to get. In many textile factories there were small steam engines driving the machinery. They were high-pressure exhaust engines, and probably used 7 lbs. of coal per i.h.p., but the exhaust steam was used for heating purposes, and the result was that the manufacturer's cost for fuel for power purposes was very small. Nominally the consumption of fuel in these cases was 7 lbs. per i.h.p., but actually, for power purposes, it was about one-third. In this way the public was led to believe that they were using many times more fuel than was actually the case. With regard to the proposed large-power scheme, if all the facts were known it might have the effect of putting the brake on the attempt to spend enormous sums upon this. He agreed that electric power from large power stations was economical where little heating was required, but in the circumstances he had mentioned the best method was to produce the power on the works and use it direct.

A Gas Engineer's Views

MR. T. GOULDEN (Gas Light and Coke Co.) agreed that a survey of the coalfields of the country would be of enormous importance, because it would enable special coals to be used for the best purpose to which they were adapted. With regard to gas manufacture, it would not be to the interest of the consumer to put the restrictions upon it which were suggested in the report of the Fuel Research Board. Gas manufacturers were great economisers of fuel. They conducted processes which gave an efficiency of not less than 70 per cent. and might reach well over 75 per cent. They not only made the best use of it from the thermal point of view, but they produced sulphate of ammonia and a large number of by-products which were essential to the industries of the country generally. If the percentage of inerts suggested in the Fuel Research Board's report was imposed it would mean that the gas industry would have to carbonise a further 10 per cent. of coal, or 2,000,000 tons in order to achieve the same result. Water-gas was now the only diluent for coal gas; it contained a small quantity of inerts, and it contained some of the constituents of ordinary gas. It was suitable to reduce high power to low power gas, and it was a desirable thing to use. If the small quantity of sulphur now in gas was to be removed, it would mean that the price to the consumer would have to be increased by a halfpenny per unit.

SIR CHARLES PARSONS (President of the Association) said that the view of Sir George Beilby, Chairman of the Fuel Research Board, was that the carbonisation of coal had not been successfully attacked on scientific lines. He thought it was far too soon to judge the Fuel Research Board. It was working hard, and he believed that in about a year's time good results would be achieved.

PROFESSOR W. H. WATKINSON said the country should have some further information as to why the output of coal in this country had decreased so much more than in America. He could not believe that it was because of the greater decreased effort of our workmen and the lesser decreased effort of the men of the United States. There must be some other factor upon which we had not been enlightened. He felt that greater economies might be effected by super-gas stations than by super-electric stations because he believed that the energy required throughout the country could be distributed as economically by gas as by electricity. Every house required heat, and he believed that the energy could best be distributed for domestic purposes by means of gas plant and with greater economy. Some years ago he carried out an experiment in his own house. The consumption of coal, gas and electricity was carefully noted, and he found that in spite of the increase of coal, gas and electricity, his total bill now was less than it was several years ago. That result was due to central heating, and although there was an objection to this here, there was an enormous saving to be effected in coal if it were effectively carried out.

LIEUT.-COLONEL WOODALL (Bournemouth Gas and Water Co.), said the country was still suffering from too much control. He could give instances of valuable gas coal being sent to water companies and Welsh coal to gas companies, coal which they could neither carbonise nor coke. The gas industry asked for greater freedom to carry on its business, not only in its own interest, but in the interest of the consumer. Although some of the suggestions in the Fuel Research Board's report might be desirable from the chemical point of view, the matter had to be looked at commercially. It was desired to produce a product best suited to the needs of the particular district, but if the suggested restrictions were imposed they would suffer in the future as in the past, and would not be able to develop on the most economical lines. The gas industry did not want to be trussed up but wished to be allowed to work out its own salvation.

Professor Armstrong Worried Again

PROFESSOR H. E. ARMSTRONG, F.R.S., said the subject was such an important one that he regretted that Sir Charles Parsons had not brought it into greater prominence in his presidential address to the Association. They all had the greatest respect for Sir George Beilby, the head of the Fuel Research Board, but there was a strong feeling among chemists that Sir George was keeping the research to himself. It must, however, be made an open one. Sir George Beilby should bring them all together time after time to discuss every issue in this important question, so that it could be dealt with properly, and he challenged him to do that. He would also offer that challenge elsewhere. The Fuel Research Board had taken on the research and had then warned everybody else off. That was absolutely unsound. Ideas were not centred in one individual or in one centre. Imagination was needed, and it was never known where it would be found. Coal was a thing of which enormous quantities were required. The gas industry required 150,000,000 tons, and that industry would go smash very soon if it did not look out. His own opinion was that the gas industry could not exist many years on its present methods. Lord Fisher had said that the Navy would have to be worked with oil. Where was it to come from? America said that 25 years hence she would have none. We should not find any in this country, but a good deal could be obtained from coal if we were careful. If Lord Fisher's programme was to be carried out, it would be necessary to obtain oil from coal in this country, but it could not be done with present methods. The gas industry could not survive as a gas industry producing its own gas and they knew it. That was why they required a reduced standard. Until the gas industry was combined with a power-producing industry they could not solve the problem of using gas for heating. Nobody would use gas for lighting in the future if they could help it. The gas industry must be combined with an industry that was producing gas as a by-product. Only within the past few months he had seen an experiment carried out with a ton of coal which gave a most magnificent heating fuel and, in addition, 18 gallons of tar, 15 lbs. of sulphate of ammonia, and 8,000 or 9,000 feet of gas. The smokeless fuel amounted to 72 per cent. of the original fuel. A coal of that kind was most valuable, and all that the gas companies would require. There was a great deal of knowledge and experience in this country on this matter, and a great many people were thinking about it. What was needed was to bring competent people together to deal with it. At the present moment it was being done in the very human way of keeping things to themselves. Sir George Beilby was a very reticent type of man and they had got to force him to be less shy.

Filling Containers with T.N.T. and Amatol—I.

By "Works Manager"

This article has been specially written for us by a chemical engineer, who for four years was in charge of an explosives filling factory. During this period the writer was responsible for the filling of over fifty million pounds of high explosive into shells and mines. We propose publishing his article in two parts, the part given this week dealing with T.N.T. Next week we shall publish the second instalment, which deals with Amatol.

At the outbreak of war the high explosive in use in the British services was lyddite, and for all practical purposes this was the sole high explosive adopted for filling shells and other containers. Lyddite has many advantages as a high explosive. It is stable and insensitive to ordinary shocks, but possesses good shattering powers when used with a powerful detonator. It has a high melting-point (122° C.), and a density of 1.6; but the high melting-point, beyond rendering it suitable for hot climates, is not an advantage, owing to reduced safety when melting for filling. When it became necessary, in the early stages of the war, to furnish high explosive in enormously increased quantities, it was at once apparent that we had not sufficient raw material for lyddite, so that a source of supply of such material for a high explosive which could be quickly made operative was of vital importance, time being the "essence of the contract." As is now well known, gas works and coke ovens in the country rose to the occasion, and in a very short time benzene and toluene were being produced in comparatively large quantities.

Detonation

Detonation may be described as the almost instantaneous splitting up of a substance into gas, either elemental gases or compounds. Explosion is a slower operation. The detonating wave may pass through the substance at the rate of 6,000 to 10,000 metres per second. It can be seen, therefore, that the value of a high explosive depends, amongst other things, on

- Volume of gas evolved per unit weight.
- Heat units formed at the chemical change.
- Density (viz., weight that can be got into the available volume of shell or container).
- Velocity of detonation.

The shattering effect depends on these four factors.

Tri-nitro-toluene satisfies all these requirements, although not as well as lyddite. Thus, its velocity of detonation is about 7,000 metres per second as a maximum, 90 to 93 per cent. that of lyddite. Its density is 1.55 to 1.60 when cast; but it rarely reaches the latter figure. As a net result, the shattering effect is only about 88 per cent. that of lyddite. It has, however, many other advantages, which resulted in its general adoption. Its lower melting-point (81.5° C.) makes it safer for melting, and this can be effected with low-pressure steam. It can safely be mixed with oxidising agents, which factor will be shown to be of the utmost value in discussing the amatols. It is a neutral substance, and does not form dangerous compounds with lead and other metals and their oxides, as in the case of lyddite. The Germans, it may be mentioned, used T.N.T. in large quantities for about twelve years before the outbreak of war, under the name "Trotyl." T.N.T. is so safe to handle that it does not come under the provisions of the Explosives Act with regard to transport and storage. There were, accordingly, sound reasons for its adoption, bearing in mind its power, safety, ease of manipulation, and source of production.

Either by itself, or as a constituent of amatol, it has been used as filling for—

- Shells—naval and military.
- Bombs.
- Rifle and hand grenades.
- Mines—fixed and floating.
- Depth charges.
- Torpedo warheads.

For mines and torpedoes it has practically displaced gun-cotton.

Grades of T.N.T.

The complete purification of the finished product is a very difficult operation, and recently the material has been placed into three grades depending on its impurities. These impurities are mostly lower nitro-compounds, oils at the ordinary temperatures, and they may be roughly gauged by the lowering of the melting-point. Thus the most impure (Grade III) may have as low a melting-point as 76° C. The melting-point of Grade I is usually round about 81°, and that of Grade II near 80°. There is, in reality, little difference between Grades I and II. In fact, during the early days these two were classed as "Pure," and Grade III as "Crude."

Previous to the enormous increase in the shell-filling programme, shells were filled with pure or crude material, large quantities of the latter being imported from America. The pure substance had the advantage of being more suitable when shells were to be sent long distances, to hot climates, or were put into store for keeping. When large quantities came to be filled, however, the supply of the pure material became insufficient, and shells filled with crude T.N.T. were the cause of considerable trouble on account of the exudation of the oil impurities. The amount was, in many cases, so considerable that it affected the exploder bags, and rendered detonation uncertain or impossible, and this fact, coupled with the shortage of T.N.T. on the further increase of the filling programme, hastened the advent of Amatol filling, which will be referred to later. In the case of mines containing heavy charges, exudation affected the mechanical operating parts in the mine case.

Methods of Filling

The following are the four chief methods adopted in filling shells :—

1. Melting and pouring direct.
2. Pouring shaped charges into one or more blocks and fitting into shells.
3. Pressing block charges and fitting into shells.
4. Stemming.
5. Pressing direct by hydraulic presses.

For mine and depth-charge filling methods 1 and 4 were almost universally applied, and for grenades the first three methods were in use. For small shells, such as 18-pounders, the second and third methods of block charges were largely employed. The capacity of small works incapable of handling large quantities was enormously increased, for the shell itself was unnecessary, the blocks being made and sent to an assembling station, where the shell was filled, exploder bags and fuses inserted, and the cartridge assembled, the complete article being despatched as fixed ammunition.

Of the total weight of high explosive filled into military and naval containers, by far the largest proportion was dealt with by the melt process.

It should be noted that the requirements called for in all fillings are :—

- Maximum density.
- Homogeneous density.
- Absence of cavitation.

T.N.T. is a crystalline substance, and, on cooling, cavitation is likely to take place in the core of the charge, and this

must be avoided. On taking for examination the section of a filling, the crystallisation at right angles to the cold side of the shell is plainly seen. Cavitation may be avoided by pouring at a temperature as near as possible to solidifying point, without allowing the mass to get "treacly," which would render complete filling difficult, and, in the case of heavy charges, taking two or more fillings to fill the container.

The T.N.T. comes to the filling station in wooden packages, containing from 40 to 100 lbs., the material being in tied linen bags. It may be in rock or cake form, flaked or finely crystalline. Owing to its low melting-point, it can be melted by low-pressure steam, and this is done in steam-jacketed pans of copper, aluminium, or, more generally, enamelled cast-iron—the capacity depending on the class of container filled. When melted the material becomes quite liquid, and runs as easily as melted wax or hot oil. It may be ladled out, or more easily run off through steam-heated cocks at the base of the pan, a fine gauze being fixed over the outlet to catch possible impurities. The pouring ladles may be of copper, brass, aluminium, tin, galvanised or tinned iron. For amatol pouring, however, copper or brass is not permitted, owing to the formation of dangerous copper ammonium salts.

The shell is filled to gauge mark, and, while still liquid, a "former" is plunged in, thus making the exact shape of the recess or cavity required for the exploder, fuse or fuse-gaine. It should be noted that the presence of alkalis in any form constitute a danger, so no utensil or table must be washed with soda-water.

The shell is afterwards painted, weighed, and duly stencilled, giving the monogram of the filling station, the date and nature of filling, the excess or deficiency in weight above or below the normal, and other information. In stations where the round is completely assembled, further operations take place, which do not come within the scope of this article.

Poured Block Filling

For this method the explosive is melted in the same manner, and poured into moulds, into which have been inserted paper cases conforming to the shape required. No former is required, as the paper case and mould are made to the correct shape, and the superfluous explosive can be merely chipped off. In 18-pounder shells, the mould can be made to admit of base pouring, and moulds can be constructed to take from two to ten paper cases at once, five being a common unit. Production is thus further increased.

Precautions

Although attention has been drawn to the stability and safety of T.N.T., it should be remembered that there is no reliance to be placed on the behaviour of any explosive, and the two dangers to be avoided are fire, and ignition due to foreign matter. These can be avoided, as far as is humanly possible, by providing adequate fire protection, both in the way of prevention as well as cure, and the risk of trouble from foreign matter by absolute cleanliness in all handling and filling operations. Attention has already been drawn to the danger of alkalis. Textile materials in all forms are potential fire agents. The striking of heavy blows with steel tools is a source of danger. With regard to fire risks, it is quite obvious that the appliance quickly at hand and instantly put into operation is of great value, hence the presence of automatic sprinklers over the melting pans and similar devices. It does not necessarily follow that a fire of T.N.T. will be followed by explosion, even in large quantities. In similar circumstances, small stores have been on fire; one of these burnt out, the other exploded after partially burning away. It is clear that as a fire reaches the core or centre of the burning material conditions become favourable to explosion, since there is a rise in temperature accompanied by an increased pressure due to the rapid formation of gases.

Health of the Workers

Elaborate precautions are taken to render the handling of minimum danger to the worker, and the reduced illness (although accompanied by a large increase in the number of workers) speaks well for the efficiency of the measures taken. In spite of what has been done, however, some few deaths, and many cases of ruined constitutions from toxic jaundice, bear witness to the danger to the workers. The causes and effects of T.N.T. poisoning were studied whole-heartedly by a committee of medical men and others, including scientists and laymen, and their conclusions after a long investigation corroborated the writer's opinions as a result of four years' experience. The medical history and physical condition of the worker is the main thing. The writer has known two men of apparently equal physical capacity commence work together, one stood it a week, while the other carried on for a couple of years and never had a day's illness. Alternation is no good for the first individual, although it may do good when dealing with large numbers. The danger from powder working through the skin is more real than that from inhaling fumes, or actually swallowing the powder. Cleanliness of the person, change of clothes after work, and abstention from alcohol all help. No sufferers from heart, chest, or lungs should undertake the work, nor those who have open wounds, sores, or bad blood. The diet should be fatty, hence the milk or cocoa given to workers. Gloves were originally worn, but later abandoned, since it was found that they were harmful, owing to powder getting imprisoned in the gloves, and the hands perspiring.

So that given the right subject to begin with, and if he or she is careful in the matters of cleanliness and diet, and takes plenty of fresh air, there will usually be no dangerous symptoms. The signs of danger are blueness of the lips, the appearance of the eyelids, the breathing and pulse, and the condition of the bowels and urine.

Sulphate of Ammonia

At a meeting of the Monmouthshire Chamber of Agriculture, Newport, last week, Mr. Thomas Hillier brought to the notice of the Chamber an objectionable clause, which he had been asked to sign when purchasing sulphate of ammonia. He had purchased four tons from a certain firm immediately after control was removed. An agreement had been sent for him to sign before the purchase was completed, and the clause he objected to was that the stuff had to be applied to the ground a fortnight after purchase. He took the matter up with the Board of Agriculture, who replied that that was the best arrangement they could come to with the Sulphate of Ammonia Association in London. He cancelled the order, but said he was ready to take it if he could put it on when he desired to do so. Thereupon he received a reply stating that the firm, after consultation with the Association in London, were ready to withdraw the clause. He thought the matter should be ventilated by the Chamber.

Mr. R. Stratton thought a much more serious feature was the increasing price of sulphate of ammonia. Last year it was £16 5s. per ton, and it was running up to £22 next March. He regarded this as a serious set-back to agriculture, and a national misfortune, when the substance was coming so much into use. They were constantly being asked to bring more land into cultivation, and sulphate of ammonia was a substance essential to increased corn production. It was most disappointing that after the war, when it had ceased to be used in munitions, it should go up to such a price.

Lord Treowen moved a resolution, which was carried unanimously, protesting against the increased price of sulphate of ammonia as a serious impediment to agriculture, and calling the attention of the Board of Trade to the subject of fertilisers.

For Infringing the Regulations for dealing in spirits of wine, J. P. Fox, chemist, Landport, Portsmouth; J. W. Chamberlain, Isleworth; and F. E. Emsley Cheaney, High Holborn, were fined respectively £100, £150, and £150, and ordered to pay £10 10s. costs each.

The Research Chemist and the War

An interesting article, written on somewhat popular lines, by Mr. Allen Abrams, appears in the August number of our American contemporary, "The Chemical Engineer." The article contains information about poison gases and protective masks which is not generally known, and illustrates the methodical manner in which America set to work to tackle the problem. It will be gathered that the writer is dealing with his subject purely from the American standpoint.

THE complete details of our achievements in chemical warfare will never be known, but it is here permitted to disclose some of the developments which led to our final supremacy in this field. Before the beginning of the war little was known of the chemist, except that he was a person who delved in scientific mysteries. There were even those who regarded him almost as an exponent of the black art. Further than this, few of us had any concern except when we lamented the fact that Germany could produce better dyes than our own chemists had made. But the chemist held his peace because he knew what we have since learned, that dyestuffs in this country had been neglected only because our scientists had greater and far more important fields for exploration. When we did enter into the production of dyes, however, these men turned to their task with such energy that in a short time they had produced materials which were equal or superior in quality to most of the German colours.

America's entrance into the war marked the assembling of the greatest scientific organisation which history records. In May, 1917, the Government had called together a number of leading scientists to help in the development of gas protection for our soldiers who were destined to go overseas, and to invent new gases and chemicals for use against the enemy. By this time the facts were clear and unmistakable that we "must meet the devil with his own fire." Let it be remembered to the credit of our governmental heads that they perceived the emergency and acted promptly.

Growth of Work

After the preliminary grounds had been covered the gas work had so expanded that it was apparent many more chemists would be required. The call which was then issued met with instant and liberal response. Central headquarters had been established in Washington and to this point there flowed a never-ceasing stream of scientists. They came simultaneously from all parts of the country. The college chairs and the industrial laboratories yielded their occupants. Professors and doctors of philosophy enlisted in the ranks beside the lad whose college days had just begun when war came on. Truly, democracy in science had found itself when thus it brought together the frock-coat and the overalls of chemistry.

And with these men came the physiologists, the doctors, the psychologists and the mechanical engineers—all so vital in this undertaking. A mere handful at first, the Chemical Warfare Service had grown to an organisation of more than twenty thousand persons when finally its work was abruptly ended. The spirit of these men and women was wonderful beyond praise. United in a common purpose and inspired by the righteousness of their cause, they turned to their tasks with unbounded energy and enthusiasm.

Nor did they limit the extent and magnitude of their efforts. Nothing, from aerial flights and the testing of explosives to the merest routine drudgery was beyond their scope. They gave their services and their bodies freely for the monotonous procedure of proving masks; for the testing of new gases and devices; and for the more dangerous work on the production of gases and explosives. It is only just to say that some of the real heroes of this war may be found among these men who stayed at home. Casualties were numerous, particularly with mustard gas; and from these some fatalities resulted.

The Chemical Warfare Service as an organisation was composed of—the Research Division, which made preliminary investigations and recommendations on all new protective devices and offence weapons; the Development Division, whose function it was to work out manufacturing procedure for new gases; the Gas Defence Division, which manufactured all protective devices; the Offence Division, devoted to the large scale production of gases; the Medical Division, carrying out physiological tests; the Proving Division, which made large scale tests of offence and defence material; and the Overseas Division concerned with field problems and conditions. In a measure the Research Division, with which we are principally concerned, embodied the others on a small scale.

Most great discoveries or inventions are the logical result of long and patient research. In this respect the American gas mask and American achievements in gas warfare were no exceptions. Thousands of men had studied for more than a year to evolve and perfect these results in every detail.

Consider the undertaking in producing the mask alone. The soldier must be supplied with a protection which would not only be complete against gases which had been previously used by the Germans, but would also neutralise any that might be employed in the future. Now the term "gas" in warfare must not be taken too literally. Offence chemical weapons of this type are invariably compressed into liquid or solid form for loading into cylinders or shells. When the resulting pressure is released, either through a valve or by the explosion of the shell, this material expands to form a "gas."

Few "Good" Gases

Thousands of compounds have been studied but few have satisfied the requirements of a "good gas." Such a substance ought to have light molecules so that more of them can be supplied by a given weight of the gas. The material should be easily liquefiable. If the gas is a compound it must not decompose quickly in contact with the shell or the atmosphere. It must have a boiling point such that vapour will come off freely under atmospheric conditions—and yet not so rapidly that the material will dissipate too soon. The substance must be extremely poisonous, or otherwise it must have some marked physiological effect, such as irritation of the tissues. Finally, the raw materials and the process for making the gas must be available on a large commercial scale.

It must be understood that an extremely small quantity of such a "good gas" is sufficient to produce the required effects. Suppose, for example, that one small drop of liquid phosgene, a very toxic compound, should be allowed to evaporate in a large room. The atmosphere would then contain somewhat more than one part of gas per million parts of air. Now if one should stay in this room for any length of time irritation would ensue and the final results would undoubtedly be fatal. When it is considered that our soldiers were frequently exposed to an atmosphere containing as high as several hundred parts of gas, the difficulty of adequate protection is better understood.

The functions of a gas mask are generally quite well known. Essentially it consists of a close-fitting rubber face-piece, to which are attached a rubber mouthpiece (much like that a football player uses) and a pair of nose-clips

which pinch the nose shut much as a clothes-pin might. Connected to the face-piece by a long, articulated rubber tubing is the canister, which contains chemicals for neutralising gas. The whole outfit is carried in a haversack hung from the shoulder. While in use, the face-piece is held securely in place by an elastic harness stretched over the head. The mouthpiece is held between the teeth like a bit, while the nose-clips close firmly, by spring tension, to cut off nasal breathing. The soldier inhales contaminated air through the canister and thence through the rubber hose to the mouth. Rubber valves are so arranged that exhaled air is not re-breathed through the canister but passes out directly from the mouthpiece. This eliminates serious damage which would otherwise occur to the chemicals. Nasal breathing is so completely shut off that any slight leak in the face-piece is of no consequence.

A correct gas mask must not only furnish complete protection to the wearer, but it should do so with a minimum exertion in breathing and a maximum comfort in usage. It is said that the old type of mask automatically reduced the fighter's efficiency by forty per cent. while he was wearing it. This may be attributed to the difficulty in breathing and seeing, combined with the inevitable physical and mental discomfort. It was therefore of prime importance that the mechanical design and proportions of the mask be correct. Numerous protective devices from abroad were studied, ranging from the "snout," drum-type of protection, as used by the Germans, to the familiar "box-respirator" of the British. During this period, however, there was no pause in the production of a satisfactory mask for the men who were then in training or going abroad.

The general public had become interested in gas warfare and many people were eager to assist with suggestions. Some of the ideas were worthy of consideration, but most of them were either amusing or quite impossible. One correspondent complacently wrote that, after some study, he had originated and completed the "perfect gas mask"; and to prove his statement a drawing of the device was enclosed. Essentially the outfit consisted of an accelerated clockworks, connected to an ordinary desk fan, which was supposed to revolve in a large hood worn upon the soldier's head. A rubber disc was pressed securely against the nose and a "filtering cup" filled with "prune stone material" furnished connection to the atmosphere. The whole design was so grotesque that it well deserves a place in the mask curiosity shop.

Another well-meaning citizen proposed the scheme of neutralising gases by other similar compounds. Unfortunately, the only gases which he could suggest for this purpose were quite as dangerous as the substances they were intended to combat.

The Eye-piece Problem

The eye-piece in itself presented an interesting but perplexing problem. Not only must the lens material allow of clear seeing and a large angle of vision, but it should cloud up as little as possible when the mask is worn in cold weather. Eye-piece materials were studied with these requirements in view, with the result that the ingenious so-called "non-shattering" lens was produced. Dimming has subsequently been obviated in the new type of mask through tube arrangements, whereby a certain portion of the incoming air is caused to flow over the eye-piece and thus to sweep off the film of moisture which may have collected.

Following the adoption of the box-respirator type of mask it was necessary to select the materials best adapted for use in the manufacture of the apparatus and most suitable for field-service conditions. Fabrics impregnated with rubber or some other substance were early shown to be most satisfactory for production of the face-piece. These materials not only resist the passage of gas, but also absorb such slight quantities of gas that they quickly aerate or give up any vapours which may be dissolved during a gas attack. The apparatus designed and employed in trying out these materials was constructed to reproduce gas conditions as they are encountered in the field. Thousands of tests were carried out, and it was through such routine procedure that the proper type of fabric was finally secured. The resistance to gas and weather corrosion of these fabrics—and, indeed, of all parts of the mask—was studied and perceptibly increased by tests similar to these.

The neutralisation of gas in the canister may take place either by actual chemical reaction or by a simple mechanical entrance of the gas into the pores of the absorbent, much as water is taken up by a sponge. Soda-lime is a typical chemical absorbent, while charcoal is the best known mechanical absorbent. The value of a porous substance like charcoal is largely dependent upon the number and size of its interstices. The porosity, in turn, is determined by the raw materials used and by the processes employed in treating these materials.

Perhaps in no single instance was there a greater need of industrial assistance than in the development of charcoal; nor was there any occasion when the response was more generous. Manufacturing plants were converted into huge laboratories, where all kinds of raw materials and procedures could be experimented upon. Furnaces were operated continuously both in the production of standard charcoal for the mask and of experimental material made in an effort to further increase the life of this absorbent against gas. Samples of the absorbent were invariably tried out against a number of war gases, since it was necessary that the charcoal possess great affinity for the particular compounds which would be encountered on the battlefield. An ingenious piece of apparatus was devised to imitate human breathing both as to rate and cyclic action. By means of this machine gas-tainted air could be drawn through the canister at any pre-determined rate until a chemical test showed that traces of gas had finally penetrated. The time required to reach this "break-point" was recorded as the "life" of the canister.

New Charcoal Made

Methods of increasing the activity or speed of absorption, and the capacity, or amount of absorption, called for extensive and very complicated research, resultant from which were charcoals far superior to any which had previously been made. The widely advertised fruit-pip campaign was of great assistance at this time because suitable charcoal materials were scarce. Once again the public responded generously and offered suggestions freely. One patriotic old gentleman sent in samples of a fine black material, explaining that it was carbon which he had scraped from the outside of a dinner pot. He suggested that this might serve as an absorbent and that "every home where cooking was done" could collect for such purposes. Then, as an after-thought, he explained that this carbon might at least be used by "our boys over there" for sharpening razors; or it could be used for shining metal and shoes!

Soda-lime, the chemical absorbent which was used in the American canister, had a special affinity for acid gases such as chlorine.

A CONFERENCE of the Executives of the various trade unions in the dyeing, bleaching, printing and allied trades was held in Manchester, on Monday, to consider the reply of the employers to the demand for a 25 per cent. increase all round. The reply was not considered satisfactory, and the question arose whether or not the members should be advised to terminate all existing agreements with a view to forcing the employers to concede the demands. In the event of agreements being terminated, strike notices would follow. About 150,000 operatives are involved, but it is probable that an effort will be made to effect a settlement.

The Inflammability of Aluminium Dust*

By Alan Leighton

ALUMINIUM dust burns quietly when in a pile, but if this pile be disturbed in such a manner as to raise a cloud of the dust into the air, the burning takes place with explosive violence. If a dust cloud already formed that has a density within the explosive limits be ignited, a violent explosion results. As several disastrous explosions of this dust have happened in manufacturing establishments, the United States Bureau of Mines has thought it worth while to investigate the physical and chemical properties of the dust with especial regard to inflammability and to the problem of extinguishing fires and of minimising the force of explosions once started. Most authors, in discussing the physical and chemical properties of aluminium, deal only with properties of the metal in mass and have little to say of the properties of the dust. As the dust will probably show all the properties of the mass to a more marked degree, reactions too slow to be observed in the mass may be very violent in the dust.

Stockmeier says that aluminium powder is ordinarily stable under friction, but that gentle rubbing after the addition of potassium chlorate causes it to explode violently. If the powder be shaken in a flask with air, it can readily be exploded by an electric spark.

Stockmeier also says that he has observed large flames of burning hydrogen when water has been employed to put out a fire in aluminium dust, and that some explosions have been caused by sparks from broken fans in ventilating systems.

He suggests a few precautions to be observed:

1.—Keep dust dry.

2.—Keep rooms at even temperature—presumably to prevent condensation of moisture and to prevent conditions favourable to the generation of large static charges of electricity.

3.—If the dust begins to darken (oxidise), immediately remove it from the room where other dust may be present, and thoroughly ventilate the place to remove any hydrogen that may have been generated.

4.—Use no naked lights.

5.—Keep the air as free as possible from dust.

Preliminary Experimental Work

The author found that aluminium dust laid as a train on a soft wood board could be ignited by short-circuiting a current of electricity through it; that when water was dropped on the burning pile a violent puff resulted; and that if the dust were spread on composition board or an iron plate, it fused with the passage of the current and burned locally, but did not burn of its own accord. It was found also that if a large iron bar was heated to a dull red heat (approximately 600° C.) aluminium dust sprinkled on it melted and stuck to the rod, but did not ignite. Evidently the ignition point of the aluminium dust is above that of coal dust, but the definite ignition temperature and the smallest concentration of dust particles necessary to propagate an explosion remain to be determined. In regard to the burning of the dust on wood, it is quite evident that the heat distilled inflammable products from the wood, which greatly accelerated the burning, and that perhaps there was enough moisture in the wood to take part in the reaction.

It seems advisable that metal sheeting or some fireproof material be used on the inside of buildings in which the dust is to be handled. Of course fireproof construction is desirable wherever inflammable substances are to be handled, but there seems to be a special need for it where a room is liable to become covered with aluminium dust.

* Abstracted from Paper No. 152, issued by U.S. Bureau of Mines.

As prepared, the aluminium dust of commerce is finely divided aluminium metal with a coating of oil, usually stearine or some similar material. This coating evidently serves to prevent oxidation in air and to protect the metal particles from the action of moisture, as it is stated that the product loses its lustre if no oil be added.

Properti.s affecting Explosibility

Aluminium dust is so light that it is easily blown about a room, and as the workmen seldom take precautions to prevent this, the workrooms are soon coated with the dust. Evidently all apparatus should be enclosed to prevent loose powder from being blown into the air. If a fan-suction system is employed to carry away the dust, it is advisable to consider the introduction of a dust precipitator a short way from the machine to collect the dust and to minimise the risk of an explosion at the bin or in the pipes. Explosions in flour mills frequently start at the fan and spread through the system to the dust room, where conditions for a violent ignition are excellent. The ventilation systems employed at the factories where the explosions occurred seemed to be designed to keep the air in rapid motion; hence they helped to suspend the dust in the rooms. There was also no device to collect the dust, and with the constant circulation of air more and more dust accumulated in the system and was thrown into suspension in the room. This must be avoided.

Attention is called to the heats of formation of most aluminium compounds. For example, the heat of formation of aluminium oxide is 392,600 calories, as compared with 103,000 calories for the formation of carbon dioxide. It is thus evident that a large amount of heat is liberated when aluminium burns, and the reaction is, of course, correspondingly more violent than the explosion of a coal-dust cloud. Also, aluminium has a high specific heat. This property of the metal may explain why so much trouble was encountered in trying to ignite clouds of aluminium dust with small sources of heat, as described elsewhere in this paper. The quantity of heat that would be stored in a red-hot pile would account for the violent reaction that takes place when water is poured on to the pile.

There may be danger in the oil coating. H. M. Wolflin, of the Bureau of Mines, in an unpublished report on the explosion at Berkeley, Cal., says:

"At the present time the plant is feeding about 0.67 per cent. of an oil of low flash point into the ball mills with the granulated aluminium. It formerly used as much as 2 per cent. and had considerable trouble with spontaneous heating." Hence it would seem that the amount of oil added should perhaps be just enough to ensure protective action and not enough to cause, on standing, conditions that favour spontaneous combustion.

If the dust starts to burn from spontaneous heating or other causes, it is very dangerous to put water on the mass; burning hydrogen is liberated immediately when the dust is thrown into the air and a terrific explosion usually results. In one case on record a violent explosion resulted from pouring molten aluminium through a screen into a bucket of water. Although such pouring had been done for several months without mishap, conditions on this particular occasion were evidently favourable for the liberation and ignition of hydrogen. As the dust clouds are readily ignited by an electric spark, all apparatus must be completely grounded. As potential differences of much more than 300 volts are necessary for sparking, the dust itself makes an excellent conductor and greatly favours the discharge of any static electricity formed.

The breaking of machinery, the poor lubrication of bearings, and the striking of metal parts, may all cause spark formation, therefore tools of the softer metals should be used wherever possible; also the machinery should be kept in good condition and inspected regularly. Spontaneous heating often takes place in piles of dust exposed to air, and evidently such heating is accelerated by an excess of oil. The remedies for such heating are self-evident; first, to prevent the collection of the dust, and, second, to regulate the amount of oil.

Experiments Conducted

The following work was conducted to determine the approximate ignition temperature of aluminium dust clouds as is done similarly with coal dust in the Clement-Frazer apparatus. Difficulties were encountered which made it impracticable to do any more than get an approximate value. In making explosibility tests of coal dust Clement used as an igniting element a coil covered with sheet platinum. To measure the surface temperature of this coil a thermocouple junction was fused directly to the sheet. To determine the ignition temperature of aluminium dust with this apparatus the platinum surfaces must be replaced with some material with which the hot aluminium will not alloy. Therefore a coil was made having as an igniting surface a heavy coating of alundum cement. In this cement the thermocouple for temperature measurements was buried. After the apparatus was assembled tests were made to determine the surface temperatures reached when definite currents were passed through the coil for a standard length of time. From these figures a temperature-current curve was plotted, and the thermocouple was removed before any aluminium dust was tested.

According to the method of procedure employed in operating the Clement-Frazer apparatus, 50 and 100 mg. of aluminium dust were successively shot up against the coil, the range of the coil temperatures being 800° to 1,200° C. Under these conditions the aluminium dust did not ignite.

At a coil temperature of 800° C. coal dust gave off some smoke, but no flame was seen. At 900° C. coal dust gave a small flame, and at higher temperatures a good ignition. If the aluminium dust was mixed with coal dust and shot up against the coil at a temperature of 900° C., the flame produced in the coal dust was brilliantly coloured by the aluminium powder. This result seems to indicate that the ignition temperature of aluminium dust is perhaps as low as, if not lower than, that of coal dust, and also that the coil in the apparatus has a heat capacity too low to heat the dust above its ignition temperature in the short time that the dust and coil are in contact.

In order to determine the effect of a body of greater heating capacity than the core of the Frazer apparatus, a small clay incinerating dish was placed in the muffle furnace. As soon as the temperature of the muffle reached 500° C. the dish was removed quickly and about 10 grams of the dust were poured into it from a small scoop; no ignition was obtained. Coal dust did not ignite at this temperature, but gave off much volatile matter as it struck the dish, and the dust that settled in the dish finally began to glow. This procedure was repeated with every 50° C. rise in the furnace temperature, and at 800° C. the aluminium cloud ignited with a brilliant flash. At this temperature and at 840°, the highest temperature employed, the coal dust cloud did not ignite. The volatile matter distilled rapidly, and the coal finally burned. The result for coal dust was anticipated, as the temperature of the dish was not as high as the so-called critical temperature of the coal as established by the Clement-Frazer apparatus.

Although these experiments do not show the exact conditions under which an ignition of the aluminium dust is obtained, they do show that it may ignite at temperatures even lower than those necessary for the ignition of 200-mesh standard Pittsburgh coal dust; also more heat is needed to ignite aluminium dust. The dust used in these tests was a commercial product labelled "aluminium bronze."

Evidently water is worse than useless to extinguish a fire in aluminium dust. It is positively dangerous. Attempts have been made to use carbon tetrachloride as an extinguisher, but this was found to be as bad as water. Probably, as suggested by A. C. Fieldner, carbon tetrachloride and aluminium form $AlCl_3$ in the presence of heat, thus liberating carbon to unite with the oxygen. The heat liberated by the formation of $AlCl_3$ in excess of that taken by the breaking up of CCl_4 is approximately equal to the heat of combustion of carbon to CO_2. If a fire in a gob of aluminium dust be isolated, a crust of aluminium oxide forms over the surface and smothers the fire. This method of extinguishing a fire is evidently dangerous, for any accident that raised the pile into a dust cloud would immediately cause an explosion. In one of the factories handling aluminium dust, oil is poured on to the fire until the oil burns and the aluminium fire is smothered, whereupon carbon tetrachloride is used to extinguish the fire in the oil.

In another factory sand is poured carefully on the pile, the pile isolated, and the fire smothered in this way. It appears that fine shale dust, such as is used in dusting coal mines to prevent explosions, may be used to advantage, as the shale makes a denser cover that excludes the air more completely. Also the dust is not free flowing, and there is less danger of any movement in the pile tending to raise a cloud, and if through accident a cloud were raised there might possibly be enough of the inert dust in the air to prevent a disastrous explosion. An investigation of the use of dry sodium carbonate in the extinguishing of these fires would be of interest. A large amount of heat is needed to decompose sodium carbonate, and the carbon dioxide freed would help to smother the fire. It is not believed that the resulting sodium oxide would be dangerous, as aluminium compounds can be reduced with either sodium or potassium.

Any liquid used in fighting the dust fires must have a low surface tension in order that the dust may be wetted. Since practically all such liquids as alcohol, etc., are very inflammable, it seems difficult to conceive of any wet method to use.

Precautions to be Observed

Use a ventilating system that will not raise loose dust into suspension nor keep it in circulation.

Use a system supplying dry air at a fairly even temperature. See that the volume of air supplied is enough to remove quickly any hydrogen from the room.

Have machinery well grounded, well cared for, and properly oiled.

Use tools of soft metal as far as practicable.

Have machinery enclosed as far as possible.

Use vacuum dust-collecting devices over machinery likely to spread dust.

Use no naked lights.

Isolate dangerous processes in separate buildings.

Avoid wood construction as far as possible.

Avoid use of liquid in putting out fires, except, perhaps, oil, with subsequent use of carbon tetrachloride.

Use sand, or preferably shale dust.

Investigate use of sodium carbonate.

THE STEAMSHIP "PETUNIA" has returned to Scotland with the members of the Scottish Spitzbergen expedition aboard. Mining engineers attached to the expedition report that they discovered a new coal-field in Spitzbergen. Much activity was found at the Norwegian mines on the island, from which 100,000 tons of coal has been exported this year, and it is stated that coal cannot be got quickly enough to meet the demand. The *Petunia* made the homeward journey on Spitzbergen coal, and her officers report very favourably on its quality.

Growth of the Kelp Organism*

By J. W. Turrentine

EARLY surveys of the areas of growing kelp, made by the Bureau of Soils from the Santa Cruz Islands, on the coast of Lower California, to the Peninsula of Western Alaska, showed in the aggregate such enormous quantities of kelp available that it appeared that here was the source of potash which might be developed into an important industry. The early surveys had little reference to the accessibility of the growing kelp or to the feasibility of harvesting it for fertiliser purposes, since at that time, of course, no plants had been constructed for the treatment of kelp, and it was not possible to bring to bear any information obtained in actual experience. Now for several years kelp potash plants have been in operation, and we are beginning to know how to estimate with some reliability the quantities of potash that can be obtained from kelp in actual commercial operations; and while these quantities are relatively small as compared with the total quantities existing as growing kelp, they are still large enough to warrant us in the belief that it will be possible to establish a kelp potash industry that for normal times will be both permanent and important.

To furnish the annual tonnage recently cut in California with certainty (400,000 to 500,000 tons), practically the entire areas of growing kelp of Southern California and the islands contiguous thereto from Point Conception southward have been required. It is entirely possible that, after greater experience in the gleaning of kelp and the conservation of the kelp beds, these areas can be made to furnish considerably more than this. At present the kelp beds are yielding three or four crops of kelp per year.

Proper Harvesting Procedure

To obtain the maximum yields, the same procedure should be observed with regard to harvesting kelp that is observed with regard to harvesting any agricultural crop that is a perennial and renews itself promptly after harvesting. That is to say, sufficient time should be permitted to elapse for the growth to renew itself fully, otherwise only an imperfect yield is obtained. Now control of the kelp beds of California lies in the hands of the State Fish and Game Commission, who declare harvested areas closed to harvesters until the growth has renewed itself completely. This undoubtedly will result in a larger yield of kelp from each bed.

But with all this, a liberal margin must be allowed over the actual tonnage required to provide against unavoidable contingencies, such as the destruction of a portion of the beds by storms or by disease, as happened during the summer of 1918 in some of the large beds in the Santa Barbara region. At the same time, it is within the realm of possibility that areas of growing kelp can be enlarged by kelp farms, and that increased economy in harvesting a larger number of crops per annum, and great improvements in the technology of the industry may all combine to bring about an enlargement of the industry here. And, besides, there are large areas of kelp on Puget Sound and in Alaska which to date are practically untouched, certainly some, and perhaps all, of which can be made to yield their quota of potash.

The kelp making up the beds of Southern California is known botanically as *Macrocystis pyrifera*, and grows in about 75 ft. of water. Its place of growth is determined by a suitable bottom whereon it can secure anchorage, and tideways or surf to keep it supplied with fresh volumes of water from which it obtains its sustenance. It is held upright in the water by small air bulbs, pneumatocysts, one at the base of each leaf, which keep it pulled upward toward the light; and on reaching the surface it continues to grow, spreading out on the surface in large tangled mats. Its total length is probably from 100 to 150 ft.

How Kelp is Gathered

With the cutting knives lowered into the water and cutting at a depth of 6 ft., the harvester is forced through this mat of growing material and cuts it loose in quantities, dragging it on board by means of an apparatus similar to the familiar reaper of the grain harvester. It is then properly stored by means of a distributer operated mechanically, the entire apparatus making possible the harvesting of some 30 tons per hour, with a total crew of not more than five men—one in the engine room, one in the pilot house, one to man the cutter and its engine, and two to distribute the load. By this simple mechanism it is possible to handle tremendous quantities of material, and the problem of harvesting would be very simple indeed if it were not for the long hauls occasioned at times by the distance of plants from the kelp beds, and the seasons of storms which interfere with harvesting.

The opinion has been expressed by operators of kelp harvesters that the kelp after having been harvested comes back in thicker growths, from which it has been concluded that there is a sort of stooling effect, as in the case of alfalfa or wheat. The lack of definite knowledge as to what actually takes place at the bottom of the ocean, 75 ft. below the surface, makes it impossible to say whether this is a true statement of what actually takes place or not. But at least it is indicative of the completeness with which the kelp beds restore themselves after being cut over. It appears probable that when the growing tip on the end of a strand of kelp is cut off, that strand dies back to the bottom, and that the prompt re-growth is the result of what might be termed as undergrowth of shorter kelp shoots, which spring to the surface promptly when the sunlight is admitted to them through the removal of the dense mass of kelp lying on the surface. When the so-called kelp roots, or, more properly, hold-fasts, are washed ashore, it is seen that there has been an actual branching; and it is quite possible that branching at the bottom is induced by cutting off the surface growth.

Investigations in Progress

Investigations are now in progress touching on all of these questions. They are purely biological, and may be termed mariculture. Some day we may have developed a definite science, or a science as definite as that of agriculture, pertaining to the growing of such things in the sea. Of course, the cultivation of seaweeds is an old-established industry of Japan. There the developments within the past few years, or since the Russo-Japanese War, have resulted in the establishment of a kelp potash industry which has made possible the production of potash and iodine there in quantities adequate to supply domestic needs in these two commodities and to make possible their exportation in certain quantities.

This is astonishing, indeed, when we remember that the kelp there dealt with grows at the bottom of the ocean and is only a few feet in length. It is gathered at a depth of some 15 ft. almost altogether by women divers, who go overboard with a knife, gather a bunch in their arms, cut it off, and come back to the surface with the bundle. If this can be done by the Japanese, it is evident that by the exercise of the proper science and economy we in this country, who have kelp growing in such a manner that it can be harvested in hundred ton lots by machinery, can likewise establish an industry of importance and value

* *Chemical and Metallurgical Engineering.*

Major & Co., Ltd.

MR. J. L. MAJOR, presiding at the ordinary general meeting of Major & Co., Ltd., last week, said that the inevitable use in building of unseasoned wood, which is so liable to the attack of dry rot, makes their Solignum wood preserving stain one of the necessities of to-day, and they are entering upon a considerable programme for its development. At the same time, the company is developing more refined specialities. "Our 'Pyramid' benzole," said Mr. Major, "has a very good name as a motor fuel. We are confining our sales, as far as possible, to a radius of fifty miles from our factories We are members of the National Benzole Association, which is doing good work in popularizing the use of benzole as a motor fuel.

"We have been spending considerable sums in research, and have just brought to success in the factory, thanks to the ability and enthusiasm of our chemists, after repeated failures, the production of an article which is required in this country and which has not hitherto been satisfactorily produced. These are just a few of the things which may interest you in connection with our business.

"I should like to take the opportunity of thanking all my associates in the business, both in office and works, for the good work they have put in under very difficult circumstances. We have no complaint to make in our own works of the slackness which one hears so much about in different parts of the country. You will be interested to know that our work-people have been given an opportunity of subscribing for shares of the company, and that a considerable number have availed themselves of it."

ESTATE VALUED AT £42,548, has been left by the late Mr. Edward Broughton Hopkins, of 74, York Street, Glasgow, distiller and merchant, and of Heathfield, Kilcreggan, Dumbarton.

From Week to Week

SIR GEORGE BEILBY has been appointed president of the newly formed British Empire Sugar Research Association.

ON THE MOUNT AUSTEN ESTATE, JOHORE, two smoke houses, containing 40,000 lb. of rubber, have been destroyed by fire.

PLANS HAVE BEEN PASSED for a machine room at Gateside Printworks, Gateside, for the Calico Printers' Association, Ltd.

THE CALICO BLEACHERS' ASSOCIATION and the Fine Spinners' Association, Bolton, intend to extend and improve their works.

AFTER SEPTEMBER 15, the offices of the Libiola Copper Mining Co., the Tyce Copper Co., and the Copper Mines of Copiapo, will be at 120, Fenchurch Street, E.C.3.

THE LATE MR. REGINALD CROOKE of Liverpool, of Messrs. P. Crooke Junr. and Co., gunpowder merchants, etc., has left estate valued at £56,711 (net personalty, £56,566).

THE BARBADOS HOUSE OF ASSEMBLY has adopted a Bill to authorize the British Union Oil Company (Limited) to construct and maintain a petroleum supply station in that island.

THE LATE MR. JAMES DORE, of Miramar, Marlborough Road, Bournemouth, formerly of John Dore & Co., brewers and distillers, etc., Bromley-by-Bow, has left estate valued at £32,942.

THE UNION AND RHODESIAN TRUST has acquired from the Public Trustee the whole of the enemy holding in the Premier Oil and Pipe Line Co.

MR. A. J. BALFOUR, O.M., it is stated, is to be nominated for election as Chancellor of Cambridge University, in succession to his brother-in-law, the late Lord Rayleigh.

PLANS HAVE BEEN PASSED for new buildings in Anniesland Road, Glasgow, for Messrs. Alexander Kennedy & Sons, Ltd., Castlebank Dyeworks.

IN CONNECTION WITH THE LOCK-OUT of compositors, lithographers, and chemists, the Norwegian Board of Trade Unions has announced sympathetic strikes in various industries. Fifty thousand workers will be affected.

THE SUM OF £12,904 (net personalty, £11,783), has been left by the late Mr. Henry Owen Huskisson, F.I.C., of The Briary, Moss Lane, Pinner, Middlesex, manufacturing chemist, of Messrs. H. O. Huskisson & Co., Moon Street, Islington, N.

IT IS EXPECTED that the Cunard Company, which has half a million tons of new construction in hand, will employ a number of the oil-driven liners which are now being built on the London-New York route.

A SOLID DYKE OF QUARTZ containing gold has been found at Copper Lake, north of The Pas, Manitoba. The dyke measures 20 ft. wide and 5,000 ft. in length, while the values are uniform throughout and average between £2 to £3 to the ton.

MR. WILLIAM ROBERT MAUD, of Market Place, Pontefract, Yorks, and of Aire Street, Knottingley, chemist and druggist, a former mayor and alderman of Pontefract, has left estate valued at £6,834.

MR. GEORGE ASH, one of the oldest members of Messrs. J. & T. Beavan, tanners, Holt, Wilts, died on September 9. He served his apprenticeship with the firm, and remained with them until he died.

MESSRS. KYNOCH (LIMITED), of Umbogintwini, Natal, have recently erected an experimental plant for the production of hydrogen peroxide. The barium peroxide method was employed, the basic raw materials being South African barytes and locally produced sulphuric acid.

OVER 155 TONS OF CHINA WOOD OIL, with 256,000 gallons of various other kinds, which include a large quantity of storm oil, are for sale, by tender, by the Disposal Board of the Ministry of Munitions. Inquiries may be addressed to 37, Old Queen Street, London, S.W. 1.

ACCORDING TO *Stubbs' Weekly Gazette*, the failures in the United Kingdom for the week ended September 13 were 21, an increase of eight. The number of bills of sale registered and re-registered was 114, an increase of 46. Mortgages and charges registered by limited companies amouted to £766,520, the amount authorised (where stated) being £404,750.

ACCORDING TO INFORMATION received from His Majesty's Charge d'Affaires at Guatemala, duplicate invoices of all postal parcels despatched to Guatemala must be sent by the consignor to the addressee, one copy of the invoice being now required by the Guatemalan Postal Authorities, in addition to the Customs declaration which is at present attached to the parcel.

MR. JOHN HOWARD THOMAS, of Moyles Court, Ringwood, Hants, a brother of the late Viscount Rhondda, chairman of the Cambrian Colleries, Ltd., and a director of the Consolidated Cambrian, Ltd., the Glamorgan Coal Co., and the Gouria Petroleum, Ltd. (net personality £10,341), has left estate valued at £19,475.

THE NEW SESSION of the Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C.3, will begin on Thursday, September 25. The work of the Institute is especially devoted to technical training in chemistry, metallurgy, and physics, and in the artistic crafts. Full details of the courses are given in the syllabus of the Institute, which can be had upon application at the office at any time, or by letter to the Principal.

THE FOLLOWING are particulars of the stocks (exclusive of old metal and scrap) in this country in possession of the Minister of Munitions on September 1: Copper, 28,049 tons; spelter, G.O.B., 20,041 tons; spelter refined, 10,963 tons; aluminium, 10,232 tons; soft pig lead, 84,057 tons; nickel, 2,374 tons; antimony regulus, 3,386 tons. A proportion of the above stocks is already sold to the trade for forward delivery.

THE INTERNATIONAL CONGRESS held at Brussels during the week from August 31 to September 6, at which representatives of all the principal countries were present, advocated the internationalisation of all patents. M. Wauters, Belgian Minister of Industry and Works, suggested that the city of Liége should be chosen as the future seat of the Universal Union of Inventions. Italy was represented at the Congress by no less than 60 members.

A FIRE BROKE OUT last Saturday, and spread with great rapidity over the 20-acre plant of the Sone and Flaming Oil Co., Brooklyn, New York, a subsidiary organisation of the Standard Oil Co. Forty huge oil tanks were involved, and the blazing oil floated down to Newtown Creek, half a mile distant, setting fire to various buildings on its way. There were numerous minor casualties but no fatalities. The damage is variously estimated at from one to five million dollars.

A FIRE OCCURRED at Messrs. Nicholson's chemical works, in the east end of Newcastle, early last Saturday morning, and a garage, motor car, and a huge pile of boxes were burnt. After saving the main premises, the firemen found both used and unused matches in considerable profusion near a safe, and signs of a forcible entrance to the premises. The conclusion come to was that the fire was caused by thieves, who fled on discovering what had occurred.

THE TREASURY announce that applications for permission under the Defence of the Realm Regulation 30 F. to raise capital in this country where the proceeds of the issue are to be applied for capital purposes outside the United Kingdom, will in future be dealt with by the Board of Trade. All communications with regard to either new or pending applications should be addressed to the Secretary, Capital Issues Committee, Board of Trade, Gydyr House, Whitehall, London, S.W.1.

IN THE SWISS CHEMICAL INDUSTRY the consolidation and extension of a broader financial basis carried out for the purpose of international competition after the war has already brought its fruits. The leading Basle firm, the Societe pour l'Industrie Chimique, has not only distributed a 27½ per cent. dividend but has also at the same time increased its share capital from 12,500,000 to 15,000,000 francs. The same policy of extension in capital has been adopted by other leading chemical firms.

ABOUT 60,000 TONS OF SHELLS filled with amatol, now stored at various depots, are announced for immediate sale. The Disposal Board of the Ministry of Munitions invites tenders from responsible firms who have facilities, or who can develop facilities, for removing the explosive and selling the resultant scrap, subject to the regulations of the Home Office. The process of removing the explosive is simple, and no elaborate machinery will be necessary. Inquiries should be addressed to Controller, Room 301, Armament Buildings, Whitehall Place, S.W.1.

PROFESSOR H. S. HELE-SHAW, of Glasgow, speaking at a meeting held at Birmingham University on Wednesday, in celebration of the Watt Centenary, put forward a strong plea that the professorship which it is proposed to endow in Birmingham University as a permanent memorial should be a Chair of Invention. As a new departure, it would be worthy of James Watt, he said, and it would stimulate the imagination. He believed it would be very popular and would be worthy of Birmingham, as the home of many great inventions and inventors.

MESSRS. STAFFORD ALLEN & SONS, LTD., manufacturing chemists, Finsbury, E.C., and of Long Melford, Suffolk are erecting extensive factory premises at Squirrell's Heath, Essex, for the manufacture of essential oils. The land adjoins the Great Eastern Railway's main line. A special siding will be laid down in the factory grounds, so that all export consignments can be loaded into trucks and run into the railway goods yard, which is almost opposite. From here, the trains will run direct to the Royal Albert and other docks.

THE YIELD OF OIL in the Chesterfield area, it is announced, has averaged a ton a day for between two and three months past. A ton is equal to seven barrels, or 245 gallons. The flow is a natural one, and has varied slightly, as much as 400 gallons being obtained one day in June. Though there is nothing remarkable about this output, it gains in importance from being a natural flow. If pumping were resorted to it is said the amount would be increased at least sevenfold, perhaps tenfold. This oil has been obtained from one borehole, that at Hardstoft, about six miles from Chesterfield, and is regarded as a hopeful sign in the exploration of the area now going on, and a justification of efforts begun on the strength of opinions formed by American geologists.

THE *Hamburger Korrespondent* authoritatively characterises as premature the announcement made by Berlin newspapers that the German-American Petroleum Co., of Hamburg, before the war importers of considerable quantities of petroleum from the United States, proposes to resume this trade in the near future. The newspaper states that the company intends again to embark upon peace activity as soon as possible, but provisionally there is no question of this being carried out, as various conditions have not yet been fulfilled, including the grant of a permit by the Allies to undertake the service. On the other hand, the company has just succeeded in obtaining from neutral countries sufficient lubricating oil to meet the needs of the German railways during the next few months.

SIR RICHARD GLAZEBROOK, on Thursday, resigned the Directorship of the National Physical Laboratory, Teddington, which he has held since its inception in 1899. Sir Richard was Principal of Liverpool University when he received the appointment to the Laboratory, which was founded by the Royal Society, and was originally intended as an extension of Kew Observatory. When the King, then Prince of Wales, opened the new buildings at Teddington in 1902 Sir Richard Glazebrook had but two departments and a staff of 26. At the present time the staff numbers about 600, and building operations are still in progress for the accommodation of new departments in research work. As already announced, Sir Richard Glazebrook is succeeded by Professor Petavel, Professor of Engineering and Director of the Whitworth Laboratory in the University of Manchester.

A CONFERENCE was held on Tuesday, in London, at the offices of the National Union of Manufacturers, attended by the representatives of 35 trade associations. The following resolution was carried unanimously: "That this meeting enters a vigorous protest at the withdrawal of the restrictions against imports without the House of Commons being given an opportunity of considering the subject and the Government trade policy in all its bearings, and desires to record its opinion that, as many industries are still engaged in turning over from war to peace conditions, the influx of foreign manufactured goods is certain to check enterprise and to aggravate the situation in regard to giving employment to workpeople in the coming winter." It was further decided that another meeting between the National Union of Manufacturers and the trade associations interested should be held before Parliament reassembled.

AT A MEETING of the Belfast Harbour Board on Tuesday, Mr. H. M. Pollock, chairman, said that Lord Pirrie, in a speech last week, stated definitely that Messrs. Harland & Wolff were able to provide, through the medium of a Diesel oil engine, from one ton of oil the same amount of energy as could be produced through the ordinary engine from four tons of coal. The Harbour Commissioners had anticipated the developemnt of oil as fuel for ships, and had been engaged for some time past in making preparations for the establishment of a great oil depot in Belfast, and the provision of wharfage which would accommodate oil tanks ranging from 10,000 to 20,000 tons, and the provision of the necessary accommodation to bunker the steamers, which, no doubt, in future would be large consumers of oil. The depot would also be close to the new corporation electricity works, so that, should it be decided in the future to use oil instead of coal, the depot would be a big advantage.

THE CAUSE OF AN EXPLOSION OF CHEMICALS, which occured with fatal result at the British Cellulose Co.'s works at Spondon, on August 8, was not definitely determined at an inquest conducted by the Derby Borough Coroner. Two process workers, F. J. Woodman, jun., and James Ridgley, were attending to vessels containing acetic acid and were about to take a sample from one of them, when there was a heavy explosion. The acid came in contact with their clothing, and they were both badly burned on the face, arms, and head. They were removed to the Royal Infirmary, where Woodman died on August 18 from septicæmia resulting from his injuries. Ridgley had sufficiently recovered to be able to attend the inquiry. Mr. A. J. Finch, one of the chemists in the services of the company, said he had been unable to ascertain any circumstances which he could definitely state was the cause of the explosion. Some brass fittings on which the acid might have so acted as to produce a highly explosive substance had now been removed, not because there was absolute proof that they were dangerous, but in order to eliminate every possible source of danger. The jury returned a verdict of "accidental death," adding that there was nothing to show the cause of the explosion.

IN THE VACATION COURT, on Wednesday, Mr. Justice Greer had before him an *ex parte* application in the matter of Brown *v.* Buckley. Mr. R. A. Wright, K.C., asked for leave to serve a notice of motion on the defendant (a Customs officer) for next Wednesday. Mr. Wright said that the action was of importance not only to the plaintiff, but also to other traders. The plaintiff, who was a chemical manufacturer, had imported a quantity of pyrogallic acid, which was now at Manchester and which had been seized by the defendant as collector of customs. The plaintiff's contention was that the seizure was entirely unjustified in law, and that the defendant was in fact a trespasser. The defendant was acting under a proclamation issued by the Government, prohibiting the import of goods except by licence of the Board of Trade. The Government purported to act under a section of the Customs Laws Consolidation Act, 1876, which provided that the importation of arms, ammunition, gunpowder, or any other goods might be prohibited by Proclamation or Order in Council. (See section 43 of the Act of 1876.) Counsel's contention would be that the Government's power under the Act of 1876 did not extend to the prohibition of goods such as pyrogallic acid, which was an ordinary article of commerce. Mr. Justice Greer: It is obviously desirable that there should be an early hearing. His Lordship gave leave to serve notice of motion for next Wednesday.

Exports of Coal-Tar Products

THE Board of Trade (Export Licence Department) desire to draw attention to the fact that the export of "coal-tar and derivatives thereof (except solvent naphtha, cresylic acid, and mixtures containing cresylic acid) suitable for use in the manufacture of dyes and explosives, whether obtained from coal-tar or other sources, and mixtures and preparations containing such products or derivatives," is still prohibited to all destinations. Certain coal-tar products, such as naphthalene and its derivatives, toluol and its derivatives, picric acid, xylol and its derivatives, carbolic acid crystals, anthracene oil, benzol and its derivatives, cresols (ortho, para, and meta) and their derivatives, were originally mentioned by name in the British list of prohibited exports, but these prohibitions have now been merged in the inclusive prohibition on the export of coal-tar products. The export of naphthalene, toluol, picric acid, and the other coal-tar products above-mentioned, should therefore be regarded as prohibited to all destinations, and applications for licences to export them should be addressed in the usual way to the Controller, Export Licence Department, 1, Queen Anne's Gate Buildings, Westminster, S.W. 1.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to The Chemical Age, *and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co. and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The weekly report contains only commodities whose values are at the time of particular interest or of a fluctuating nature. A more complete report and list are published once a month. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.*

Market Report

Thursday, September 18, 1919.

The demand for chemicals has been fairly active during this week, and values generally do not show much change.

There is a fair volume of business passing for export, but, of course, the serious fluctuations in exchange retard business with some markets to a certain extent.

General Chemicals

Acetic Acid.—There is a revival in the demand from the North, and sales are being freely made at full market prices.

Acid Carbolic.—Inquiries from abroad continue to flow in and makers can easily realise good prices.

Acid Oxalic is in fair request at makers' quotations.

Acid Tartaric.—Consumption shows no signs of falling off at home, whereas export business is exceptionally good.

Ammonium Salts are in active request. Salammoniac has been advanced for delivery during the early months of next year.

Arsenic.—The scarcity is being keenly felt, and prices continue to advance.

Barium Chloride.—There has been a slightly better demand, and price is unchanged.

Copper Sulphate.—This market is still without feature, and only an extremely small business has been done There is, however, rather more inquiry to report.

Formaldehyde.—Owing to the arrival of a few shipments the spot position has been relieved. The market is expected to go appreciably higher.

Lead Acetate is slightly easier, and a fair business has been transacted.

Lithopone.—The active demand continues, and prices remain unchanged.

Methyl Acetone.—This solvent may be dearer presently, in consequence of the rise in methyl alcohol.

Potassium Chloride.—There has been rather more demand for this chemical, and a few export orders have been placed.

Potassium Prussiate is slow of sale and the price easy.

Sodium Acetate.—The price is slightly lower, with little business passing.

Sodium Hyposulphite has been active and the value unchanged.

Sodium Prussiate is scarce on the spot, and the price has been further advanced.

Zinc Salts are steady, without change in values.

Coal Tar Intermediate Products

Prices are unchanged, and some good orders have been placed.

Aniline Oil.—A steady business has been transacted.

Aniline Salt is very scarce for near delivery, and makers are heavily sold.

Beta Naphthol.—Some large orders have been recently placed and the price is firmer, and we should not be surprised to see a further advance in price before long.

H Acid.—There is rather more inquiry for this intermediate, and it can now be obtained in the dry form.

Heavy Coal Tar Products

Markets generally are firm, and a fair amount of business is passing.

Benzol.—The greater part of the Government stock has now been disposed of and prices are firm. There is a fair enquiry for export at 1s. 10½d. to 1s. 11½d. per gallon, while prices for home trade are unchanged.

Creosote.—Only very limited quantities are offering and prices are well maintained at 5½d. per gallon in the North, and 5¾d. to 6½d. in the South.

Cresylic Acid.—There is only a moderate demand, but prices are well maintained. Sellers ask 2s. 6d. to 2s. 9d. per gallon for pale 97 per cent., and 2s. 3d. to 2s. 6d. for dark 95 per cent.

Pitch.—The demand continues good, and business is reported at 82s. 6d. f.o.b. London, and there are sellers at 75s. f.o.b. East Coast, and 65s. f.o.b. West Coast.

Solvent Naptha is in good demand, and an advance of a penny to twopence per gallon has been paid.

Sulphate of Ammonia

Business for export is very limited and prices are high, while there is no change in the home market.

Current Prices

Chemicals

	per	£	s.	d.		£	s.	d.
Acetic anhydride	lb.	0	2	9	to	0	3	0
Acetone, pure	ton	95	0	0	to	97	0	0
Acid, Acetic, glacial, 99-100%	ton	82	10	0	to	84	0	0
Acetic, 80% pure	ton	65	0	0	to	67	10	0
Carbolic, cryst. 39-40°	lb.	0	0	9½	to	0	0	10
Citric	lb.	0	4	4	to	0	4	5
Lactic, 50 vol.	ton	66	0	0	to	68	0	0
Lactic, 60 vol.	ton	83	10	0	to	85	0	0
Oxalic	lb.	0	1	2	to	0	1	2½
Pyrogallic, cryst.	lb.	0	11	6	to	0	11	9
Tannic, commercial	lb.	0	2	9	to	0	3	0
Tartaric	lb.	0	3	2	to	0	3	3
Alum, lump	ton	17	10	0	to	17	15	0
Aluminium, sulphate, 14-15%	ton	14	0	0	to	14	10	0
Aluminium, sulphate, 17-18%	ton	17	10	0	to	18	10	0
Ammonia, anhydrous	lb.	0	1	8	to	0	1	9
Ammonia, .880	ton	32	10	0	to	35	0	0
Ammonia, carbonate	lb.	0	0	6½	to		—	
Ammonia, muriate (galvanisers)	ton	45	0	0	to	46	0	0
Ammonia, nitrate	ton	55	0	0	to	57	10	0
Ammonia, phosphate	ton	115	0	0	to	120	0	0
Arsenic, white, powdered	ton	58	0	0	to	60	0	0
Barium, carbonate, 92-94%	ton	12	0	0	to	13	0	0
Chloride	ton	24	0	0	to	24	10	0
Nitrate	ton	50	0	0	to	51	0	0
Sulphate, blanc fixe, dry	ton	25	10	0	to	26	0	0
Sulphate, blanc fixe, pulp	ton	15	10	0	to	16	0	0
Bleaching powder, 35-37%	ton	13	10	0	to	14	0	0
Borax crystals	ton	39	0	0	to	40	0	0
Calcium acetate, grey	ton	21	10	0	to	22	10	0
Chloride	ton	8	10	0	to	9	0	0
Casein, technical	ton	80	0	0	to	83	0	0
Cobalt oxide, black	lb.	0	7	9	to	0	8	0
Copper sulphate	ton	40	0	0	to	44	0	0
Cream Tartar, 98-100%	ton	245	0	0	to	250	0	0
Epsom Salts (see Magnesium Sulphate).								
Formaldehyde 40% vol.	ton	140	0	0	to	142	10	0
Iron perchloride	ton	32	0	0	to	34	0	0
Iron sulphate (Copperas)	ton	4	12	6	to	4	15	0
Lead acetate, white	ton	82	10	0	to	84	0	0
Carbonate (White Lead)	ton	51	0	0	to	55	0	0
Nitrate	ton	57	0	0	to	58	0	0
Lithophone, 30%	ton	44	0	0	to	45	0	0
Magnesium chloride	ton	15	0	0	to	16	0	0
Carbonate, light	cwt.	2	15	0	to	3	0	0
Sulphate (Epsom salts commercial)	ton	11	10	0	to	11	10	0
Sulphate (Druggists')	ton	17	0	0	to	17	10	0

	per	£	s.	d.		£	s.	d.
Methyl acetone	ton	89	0	0	to	90	0	0
Alcohol, 1% acetone	gall.	0	11	6	to	0	12	0
Potassium bichromate	lb.	0	1	6	to	0	1	7
Carbonate, 90%	ton	95	0	0	to	98	0	0
Chlorate	lb.	0	1	1	to	0	1	2
Meta-bisulphite, 50-52%	ton	210	0	0	to	220	0	0
Nitrate refined	ton	58	0	0	to	60	0	0
Permanganate	lb.	0	3	3	to	0	3	6
Prussiate, yellow	lb.	0	1	9	to	0	1	10
Prussiate red	lb.	0	6	0	to	0	6	3
Sulphate 90%	ton	31	0	0	to	33	0	0
Salammoniac, firsts	cwt.	4	0	0				
Seconds	cwt.	3	15	0				
Sodium acetate	ton	50	0	0	to	52	0	0
Arsenate, 45%	ton	60	10	0	to	62	0	0
Bicarbonate	ton	9	10	0	to	10	0	0
Bisulphite, 60-62%	ton	32	0	0	to	33	0	0
Chlorate	lb.	0	0	6½	to	0	0	7
Caustic, 70%	ton	20	10	0	to	21	0	0
Caustic, 76%	ton	23	0	0	to	24	0	0
Hyposulphite, commercial	ton	18	0	0	to	18	10	0
Nitrite, 96-98%	ton	57	0	0	to	59	0	0
Phosphate, crystal	ton	26	0	0	to	26	10	0
Prussiate	lb.	0	0	8½	to	0	0	9
Sulphide, crystals	ton	15	10	0	to	16	0	0
Sulphide, solid, 60-62%	ton	20	0	0	to	21	0	0
Sulphite, cryst.	ton	11	0	0	to	11	10	0
Strontium carbonate	ton	85	0	0	to	90	0	0
„ Sulphate, white	ton	8	10	0	to	10	0	0
Sulphur chloride	ton	38	0	0	to	40	0	0
Tetrachlorethane (Westron)	ton	60	0	0	to	65	0	0
Tin perchloride, 33%	lb.	0	2	4	to	0	2	5
„ Protochloride (tin crystals)	lb.	0	1	9	to	0	1	10
Trichlorethylene (Westrosol)	ton	75	0	0	to	80	0	0
Zinc chloride 102 Tw.	ton	22	0	0	to	23	0	0
Chloride, solid, 96-98%	ton	60	0	0	to	62	10	0
Sulphate	ton	21	10	0	to	23	0	0
Oxide, Redseal	ton	75	0	0	to	80	0	0

Coal Tar Intermediates, &c.

	per	£	s.	d.		£	s.	d.
Alphanaphthol, crude	lb.	0	3	0	to	0	3	6
Alphanaphthol, refined	lb.	0	3	6	to	0	3	9
Alphanaphthylamine	lb.	0	2	6	to	0	2	9
Aniline oil, drums free	lb.	0	1	1	to	0	1	2
Aniline salts	lb.	0	1	5½	to	0	1	6½
Anthracene, 85-90%	lb.	0	1	5	to	0	1	6
Benzaldehyde (free of chlorine)	lb.	0	3	6	to	0	3	9
Benzidine, base	lb.	0	5	6	to	0	6	0
Benzidine, sulphate	lb.	0	4	9	to	0	5	0
Benzoic, acid	lb.	0	5	0	to	0	5	3
Benzoate of soda	lb.	0	5	0	to	0	5	3
Benzyl chloride, technical	lb.	0	1	9	to	0	2	0
Betanaphthol benzoate	lb.	1	6	0	to	1	7	6
Betanaphthol	lb.	0	2	3	to	0	2	6
Betanaphthylamine, technical	lb.	0	6	6	to	0	7	0
Dichlorbenzol	lb.	0	0	5	to	0	0	6
Diethylaniline	lb.	0	7	0	to	0	8	0
Dinitrobenzol	lb.	0	1	4	to	0	1	6
Dinitrochlorbenzol	lb.	0	1	2	to	0	1	3
Dinitronaphthaline	lb.	0	2	0	to	0	2	3
Dinitrotoluol	lb.	0	1	10	to	0	2	0
Dinitrophenol	lb.	0	1	3	to	0	1	6
Dimethylaniline	lb	0	2	9	to	0	3	0
Diphenylamine	lb	0	3	0	to	0	3	3
H-Acid	lb.	0	10	6	to	0	11	0
Metaphenylenediamine	lb.	0	4	6	to	0	4	9
Monochlorbenzol	lb	0	0	9	to	0	0	10
Metanilic cid	lb.	0	7	6	to	0	8	6
Monosulphonic Acid (2:7)	lb.	0	7	0	to	0	8	0
Naphthionic acid, crude	lb.	0	3	6	to	0	3	9
Naphthylamin-di-sulphonic acid	lb.	0	4	6	to	0	5	0
Nitronaphthaline	lb.	0	1	2	to	0	1	3
Nitrotoluol	lb.	0	1	3	to	0	1	6
Orthoamidophenol, base	lb.	0	18	0	to	1	0	0
Orthodichlorbenzol	lb.	0	1	1	to	0	1	3
Orthotoluidine	lb.	0	2	2	to	0	2	3
Orthonitrotoluol	lb.	0	1	6	to	0	1	9
Para-amidophenol, base	lb.	0	14	0	to	0	15	0
Para-amidophenol, hydrochlor.	lb.	0	15	6	to	0	16	0
Paradichlorbenzol	lb.	0	0	4	to	0	0	5
Paranitraniline	lb.	0	3	6	to	0	3	9
Paranitrophenol	lb.	0	1	10	to	0	2	0
Paranitrotoluol	lb.	0	5	3	to	0	5	6
Paraphenylenediamine, distilled	lb.	0	14	0	to	0	15	0
Paratoluidine	lb.	0	7	0	to	0	7	6
Phthalic anhydride	lb.	0	6	0	to	0	7	6
Resorcin, technical	lb.	0	11	0	to	0	12	0
Resorcin, pure	lb.	0	17	6	to	1	0	0
Salicylic acid	lb.	0	2	6	to	0	2	8
Salol	lb.	0	4	9	to	0	5	0
Sulphanilic acid, crude	lb.	0	1	2	to	0	1	3
Tolidine, base	lb.	0	9	0	to	0	10	0
Tolidine, mixture	lb.	0	2	9	to	0	3	0

The Calendar

Sept.		
22–27	National Exposition of Chemical Industries	Chicago.
24–25	Institute of Metals ... ... (Annual Meeting.)	Sheffield.
Oct.		
1	Institution of Automobile Engineers	Royal Society of Arts, John Street, Adelphi, W.C.
1	Eastern Counties' Gas Managers' Association (Annual Meeting.)	Salisbury House, London Wall, E.C.
3	Society of Chemical Industry (Manchester Section.) Chairman's Address, and Paper by Mr. J. Allan (Some Notes on the Rhineland Chemical Works.)	The Grand Hotel, Manchester.

British Sugar Beet

THE British Sugar Beet Growers' Society, 14, Victoria Street, S.W. 1, in a survey of the results of the first year's operations of its estate at Kelham, near Newark, states that after providing for interest on capital invested in the estate, there is a substantial surplus based on an independent professional valuation on conservative lines. This must be regarded as very satisfactory, in view of the foul state of the land when bought, and the expenditure incurred in deep ploughing and in the preparation of large fields with the view of introducing sugar beet as the main crop. The estate comprises 5,603 acres. About one-half of this is being farmed as a large farm, with the ultimate object of introducing sugar beet as the main crop after the factory is erected. In the meantime, it is devoted to cereals and stock, with a small area of sugar beet for feeding and for seed production. The remainder is to be planned out as a land settlement scheme on the lines of the farm colonies of the Board of Agriculture, thus assisting in drawing additional labour to the sugar beet industry in its double aspect of field and factory.

THE *Board of Trade Journal* publishes the following communication from the British Military Governor at Cologne:—"For the last few months prospecting for iron and manganese has been taking place in the Idarwald, about 50 kilometres south of Coblentz. It was known before the war that there were deposits of iron ore in this region, but with the Lorraine ironfields in their possession, the Germans did not consider the exploitation of the ore deposits in the Idarwald profitable enough. The work of the last few months, however, has given very satisfactory results, and it appears that the whole of the Idarwald contains rich ore deposits. Deposits have already been discovered in the regions of Rhaunen-Sulzbach Weitersbach, and Horbruch (about 20 kilometres west by south of Berncastel). The ore has been discovered at a depth of from 6 to 10 feet, but in several places also just below the surface. Analysis shows that it contains from 55 per cent. to 60 per cent. metal, and up to 30 per cent. manganese. Its transport could be effected at a small cost by means of the Hunstuck railway.

References to Current Literature

Only articles of general as distinct from specialised interest are included and given in alphabetical order under each geographical subdivision. By publishing this digest within two or three days of publication or receipt we hope to save our readers time and trouble; in return we invite their suggestions and criticisms. The original journals may be consulted at the Patent Office or Chemical Society's libraries. A list of journals and standard abbreviations used will be published at suitable intervals.

British

AMMONIUM NITRATE. The evaporation of concentrated and saturated solutions of ammonium nitrate, vapour pressures, heats of solution, and hydrolysis. E. B. R. Prideaux and R. M. Caven. *J. Soc. Chem. Ind.*, September 15, 353-355T. Data are presented bearing on industrial evaporation practice.

CONCRETE. Permeability of concrete. S. Bowman. *J. Soc. Chem. Ind.*, September 15, 325-327R. Notes on the investigation of waterproofing agents for concrete.

CORROSION. Note on a peculiar case of corrosion by electrical leakage. W. S. Patterson. *J. Soc. Chem. Ind.*, September 15, 330T. A record of the destruction of bricks behind an electrical fuseboard.

EXPLOSIONS. Note on explosions in coal mines. G. Harker. *J. Soc. Chem. Ind.*, September 15, 338T. Also J. S. Haldane. *Loc. cit.*, 338-339T. Notes on Harger's proposals to dilute mine air with flue gas.

FOOD. Problems of food and our economic policy. H. E. Armstrong. *J. Roy. Soc. Arts*, September 12, 667-676. Second Cantor Lecture. (See also CHEMICAL AGE, p. 368.)

FUEL ECONOMY. Fuel control in metallurgical furnaces. R. A. Hadfield and R. J. Sarjent. *Iron and Steel Inst.*, September meeting (advance copy), 13 pp. The design and control of furnaces is dealt with.

FUEL ECONOMY IN CUPOLA PRACTICE. H. James Yates. *Iron and Steel Inst.*, September meeting (advance copy), 7 pp.

REPORT ON THE EXPERIMENTAL USE OF POWDERED FUEL FOR PUDDLING FURNACES. W. Simons. *Iron and Steel Inst.*, September meeting (advance copy), 2 pp.

REPORT ON FUEL ECONOMY AND CONSUMPTION IN THE MANUFACTURE OF IRON AND STEEL. *Iron and Steel Inst.*, September meeting (advance copy), 42 pp. A report presented by W. A. Bone, Sir R. Hadfield, and A. Hutchinson on behalf of the British Association Fuel Economy Committee.

REPORT ON THE PRESENT STATUS OF FUEL ECONOMY IN THE GERMAN IRON AND STEEL INDUSTRIES OF THE OCCUPIED TERRITORY ON THE LEFT BANK OF THE RHINE. C. Johns and L. Ennis. *Iron and Steel Inst.*, September meeting (advance copy), 19 pp.

IRON. Synthetic cast iron. C. A. Keller. *Iron and Steel Inst.*, September meeting (advance copy), 19 pp. An account of the origin, development, and present practice of the production of iron by recarburising meltings of steel turnings.

LIME. The necessity for a supply of pure agricultural lime. G. S. Robertson. *Analyst*, September, 309-314.

PACKAGES. Shipping containers. C. P. Beistle. *J. Soc. Chem. Ind.*, September 15, 330-337T. A description of the efforts of the U.S. Bureau of Explosives to promote safety in the transport of dangerous goods.

Liners for Shipping Containers. B. Askell. *J. Soc. Chem. Ind.*, September 15, 337T. Notes on elastic paper linings for sacks for use with salt, chemicals, &c.

Paper Barrels and the like. A. H. Searle. *J. Soc. Chem. Ind.*, September 15, 337-338T. A brief description of a machine for making paper barrels, etc.

PATENTS. The Patents and Designs Bill, 1919. *J. Soc. Chem. Ind.*, September 15, 323-325R, contains the following:—I. By R. L. Mond (from the point of view of the chemical manufacturer). II. By A. G. Bloxam (from the standpoint of the chartered patent agent). III. By D. Leechman (from the viewpoint of the inventor).

SHALE OIL. Note on the yield of mineral oil from certain low-grade coals (shales). S. R. Illingworth. *J. Soc. Chem. Ind.*, September 15, 355T. Shales mined at the Old Roundwood Collieries, Wakefield, have been examined.

STEAM. Production of steam from low-grade fuel. P. Parrish. *J. Soc. Chem. Ind.*, September 15, 327-328T. Additional data to paper previously recorded (CHEMICAL AGE, p. 124), with contributions to discussion.

STEEL. The decarburation of steel with hydrogen. E. D. Campbell. *Iron and Steel Inst.*, September meeting (advance copy), 8 pp. An account of experiments made to determine the best decarburising conditions

American

BRITISH GUIANA. Industrial and agricultural chemistry in British Guiana. C. A. Browne. *J. Ind. Eng. Chem.*, September, 874-881. Contains notes on sugar and its by-products, balata, soils, and bauxite, special reference being made to the work of Professor J. B. Harrison.

ELECTRIC FURNACES. The design of electric furnaces. R. C. Gosrow. *Chem. and Met. Eng.*, September 1, 235-241. A discussion of the principles of the design of electric furnaces, with special reference to ferro-manganese.

FUEL. Colloidal fuels. L. W. Bates (Pamphlet, August, 141, Broadway, New York.) 28 pp. Deals with the relation of colloidal fuels to coal, to the production of power and heat, and to fire prevention and insurance.

GAS. Ammonia in producer gas. F. K. Ovitz. *Chem. and Met. Eng.*, September 1, 253-255. A description of tests on gas from producers of the Smith type.

GAS WARFARE. Manufacture of war gases in Germany. J. F. Norris. *J. Ind. Eng. Chem.*, September, 817-829. Detailed descriptions of the processes and plant used are given; reference is also made to gas-mask charcoal.

An artillery gas attack. B. C. Goss. *J. Ind. Eng. Chem.*, September, 829-836. An account of the construction of gas shells and the use of gases in artillery.

METALS. Apparatus for determining the thermal conductivity of metals. G. B. Wilkes. *Chem. and Met. Eng.*, September 1, 241-243.

NITROGEN COMPOUNDS. The production of nitrogenous compounds synthetically in the United States and Germany. R. E. McConnell. *J. Ind. Eng. Chem.*, September, 837-842. Deals particularly with the Haber ammonia plant at Oppau.

POTASH. Potash from kelp. The experimental plant of the U.S. Department of Agriculture. J. W. Turrentine and P. S. Shoaff. *J. Ind. Eng. Chem.*, September, 864-874. The plant and practice at Summerland, California, are described.

PYROMETRY. A new compensated heatmeter. C. P. Frey. *Chem. and Met. Eng.*, September 1, 259-261. A description of a meter invented by P. D. Foote and T. R. Harrison, of the U.S. Bureau of Standards.

STEEL. Electrolytic resistance method for determining carbon in steel. J. R. Cain and L. C. Maxwell. *J. Ind. Eng. Chem.*, September, 852-860.

French

HEAT EXCHANGERS. G. Bastien. *Mem. Soc. Ing. Civils de France*, April-June, 183-237. A valuable paper, containing many thermal data relating to fluids used to supply heat, and formulæ for applying these to heat-interchange problems.

LUBRICATING OILS. The regeneration of lubricating oils. *Ann. Falsif.*, July-August, 217-218. Notes on Rialland's process for rendering lubricating oils fit for re-use.

German

HYDROGEN. Production of hydrogen from carbon monoxide and hydrated lime. W. H. Engels. *J. Gasbeleucht*, August 30, 493-500. Conclusion of article (see CHEMICAL AGE, p. 368) dealing with the acceleration of hydrogen production by means of iron oxide.

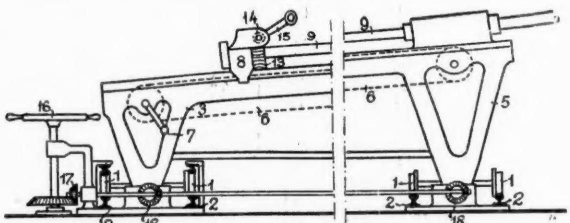
Patent Literature

We publish each week a list of selected complete specifications accepted as and when they are actually printed and on sale. In addition, we give abstracts within a week of the specifications being obtainable. Readers can thus decide what specifications are of sufficient interest to warrant purchase, the only way of obtaining complete information. Lists of patent applications and of " convention " specifications open to inspection before acceptance are added; abstracts of the latter appear as soon as possible thereafter.

Abstracts of Complete Specifications

118,284. Rotary Kilns, Devices for removing Crust Formation in. M. Vogel-Jörgensen, Nyelandsvej 103, Frederiksberg, near Copenhagen. International Convention date (Sweden), February 28, 1917.

A paring tool for removing the crust from a rotary kiln is attached to the holder 9 which is connected to the upper part of

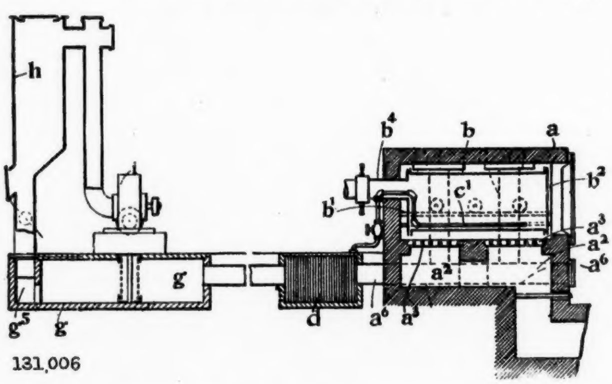


118,284

a continuous chain 6 by means of a projection 8. The tool may be displaced longitudinally into and out of the kiln by turning the handle 7. In order to adjust the tool to the most suitable position in the kiln, it may be turned on its own axis by means of a handle 15, worm 14, and worm wheel 13. The carriage is mounted on two sets of rollers 1 running on rails 2, and may be displaced laterally by means of a handle 16 operating through bevel gears 17, 18. The wheels 18 are carried on transverse spindles working in nuts in the brackets 3, 5. Means may also be provided for the automatic adjustment of the feed of the paring tool.

131,006. Wood, Woody Fibre, Peat and similar Carbonaceous Substances, Destructive Distillation of. P. Poore, 8, Old Jewry, London, E.C. Application dates, September 17, 1917, and March 20, 1918.

The furnace *a* is provided with parallel heating chambers for retorts *b* which are closed by covers b^1, b^2, the vapour being discharged through pipe b^4. A steam pipe c^1, having a perforated end portion, extends through the vapour outlet b^1 into the retort. Hot gases from the grate pass into the flue a^2 and thence into the heating chamber through the grid a^3. The gases pass round the retort and then down through vertical flues into the horizontal flue a^6. The gases then pass through the superheater *d*, through



131,006

which the steam is passed on its way to the retort, and thence to a settling and dust-removing chamber *g* provided with gauze screens. The filtered gas together with air from the inlet g^5 passes upward into the vertical drying kiln *h* in which the wood, etc., is dried before being transferred into the retorts. An exhaust fan *i* ensures circulation of the hot gas. The dried material is heated in the retorts to a temperature slightly above 100° C. before introducing the superheated steam, to obviate condensation of the steam.

131,017. Ammonium Nitrate, Production of. C. W. Bailey, H. S. Denny, and A. T. Jefferis, H.M. Factory, Langwith, Notts. Application date, March 20, 1918.

Ammonium sulphate, sodium nitrate, sodium bisulphate and water are mixed and heated, whereby sodium sulphate and ammonium nitrate are formed, and the former partly separates out. The residual solution is cooled and ammonium nitrate then crystallises and is separated. The solution then remaining may be mixed with a further proportion of sodium nitrate, ammonium sulphate and sodium bisulphate, when the sodium sulphate may be separated at a higher temperature and the ammonium nitrate at a lower temperature, and the process is rendered cyclic.

131,029. Nitric Acid, Production of. K. B. Quinan, Somerset West, Cape Province, South Africa. Application date, March 27, 1918.

In the manufacture of nitric acid from gases containing oxides of nitrogen by absorption in water or dilute nitric acid, the use of the usual absorption towers is obviated by distributing the liquid over the surfaces of permeable diaphragms through which the gas is passed upward under such conditions that percolation of liquid through the diaphragms is prevented. The diaphragms may consist of perforated plates, the holes in which are of suitable size. In order to allow oxidation of the nitric oxide produced by the reaction, oxidation chambers are provided between successive absorption chambers. Means may be provided for varying the area of the gas passages in the permeable diaphragm by covering some of the passages.

131,049. Ammonia, Synthetic Production of. E. B. Maxted, 63, Highgate Road, Walsall, Staffs. Application date, April 4, 1918.

A mixture of nitrogen and hydrogen with traces of carbon monoxide, which is to be used for the production of ammonia, is subjected to preliminary treatment with a nickel or cobalt catalyst at a temperature of 350°—450° C. The carbon monoxide is thereby hydrogenated, but ammonia is not produced under these conditions. The purified gas is then used for the ammonia synthesis.

131,061. Electric Furnaces. Dr. J. A. Fleming, University College, Gower Street, London. Application date, April 9, 1918.

The furnace is constructed of an inner fireclay cylinder or a silica tube, surrounded by a thick layer of silicate cotton. The heating device is in the form of wire loops suspended from projections on the inner walls of the furnace so as to hang close to, but not touching the walls. The loops are kept in position by their own weight, and may be arranged so as to work with a two or three phase current.

131,091. Hydrogen, Liberation of—from Mixtures containing it. L'Air Liquide, Société Anonyme pour l'Etude et l'Exploitation des Procedes G. Claude, 48, Rue St. Lazare, Paris. International Convention date (France), November 17, 1917.

In the process for obtaining hydrogen by its smaller solubility in certain solvents under certain conditions of pressure and temperature described in No. 130,357, the solvent is cooled by the expansion of the gases liberated from it to the necessary low temperature. This may be done by admitting the saturated solvent to the larger area of a differential piston of a motor, and pumping the de-saturated solvent to the apparatus by admitting it to the smaller piston area.

131,095. Kilns for the Incineration of Earth Matters, and Dolomites, Limes, and Cements. T. Hodson, Fairmount, Hackney, Matlock. Application date, May 7, 1918.

The kiln is tapered at its middle part, and then enlarged again to form an incinerating chamber of smaller diameter which is

surrounded by heating furnaces. Flues are provided leading from the furnaces into the incinerating chamber. The gases are discharged from a central flue at the highest point of the kiln, and charging doors are provided on each side of this flue.

131,105. Distillation, Gasification and the like of Carbonaceous Materials and the separation of the Volatile Matter therefrom. W. E. Davies, Brynawel, Vicarage Road, Penygraig, Tonypandy, Wales. Application date, July 3, 1918.

The gas evolved in the retort is mixed with a gas free from oxygen, which is subjected at the point of admission to the retort to the action of an electric potential sufficient to cause ionisation. The admixed gas may be combustion products, producer gas, blast furnace gas, hydrogen, steam, hydrocarbons, carbon dioxide or monoxide, or nitrogen. The ports for admission of the ionised gas may be arranged along the wall of the retort, and the mixed gases are withdrawn through other ports which are provided with electrodes which are oppositely charged. An increased yield of ammonia, benzene or toluene is obtained by suitably selecting the gas to be added.

131,125. Tar, Removing from gas. O. A. L. Heise, Copenhagen. Application date, August 10, 1918.

The gas is passed upward through a filtering material consisting of heath-faggots, while hot water is sprayed on to the material from above so as to remove the tar as it is collected.

131,126. Gas Producers, Fire-grates for. O. A. L. Heise, Copenhagen. Application date, August 10, 1918.

Two superposed fire-grates are used with a small space between them. Each grate may be separately removed through openings in the side wall so that slag may be cleaned off without interrupting the action of the producer.

131,127. Gas Generators, Preheater for. O. A. L. Heise, Copenhagen. Application date, August 10, 1918.

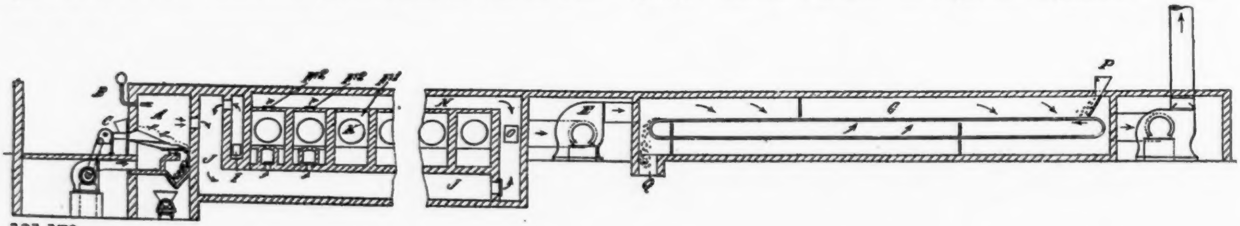
The generator is provided with an internal iron lining, around which a coiled tube is arranged embedded in the insulating material, and slightly spaced from the lining. The tube is thus protected from the direct action of the fire.

131,169. Gas Producers. H. V. Senior, Aisthorpe, Lincoln, and A. D. Bates, St. Rumbold Street, Lincoln. Application date, August 22, 1918.

In a gas producer using wood refuse or waste fuel, the depth of the fuel bed is regulated by making the container in two or more telescoping parts. The parts may be conical so that the diameter increases downward, and they may be stepped abruptly, so as to prevent jamming of the charge. Stirring implements may be inserted vertically through the stepped portion at the top of each truncated section.

131,179. Drying, Carbonising, Roasting or like Treatment of Materials, Two-stage Apparatus for. Erith's Engineering Co., Ltd., and C. Erith, 70, Gracechurch Street, London, E.C.3. Application date, August 29, 1918.

Apparatus is provided for drying and carbonising moist fuels, such as wood, lignite, peat or moist coal. The furnace A is fed with solid fuel by a mechanical stoker C and is also provided with a gas burner B. The combustion products, mixed with air from

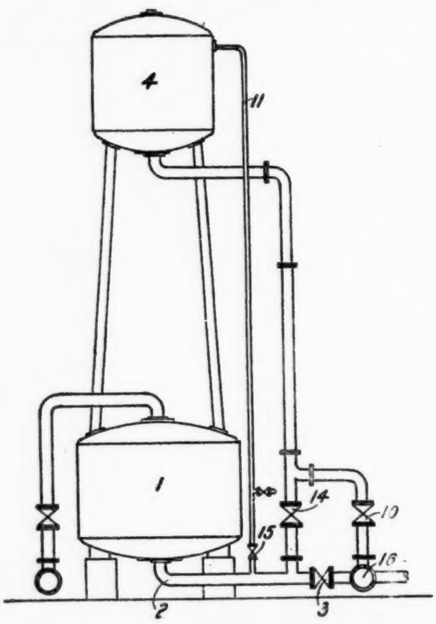


131,179

the inlet I, pass along the flue J and thence into the chambers F^1 containing the retorts K. The waste gas then passes through the openings F^2 into the flue N. More air is admitted by the inlet O and the mixture is delivered by the fan E into the drying chamber G. The raw material is fed by the hopper P on to the endless conveyor, which carries it in counter-current to the hot gas in order to dry it, and the material is then discharged through the opening Q into one of the retorts K, which is then transported to a heating chamber F^1. The burner B may be fed with by-product gas.

131,198. Filters for the Purification of Liquids. F. P. Candy, 5, Westminster Palace Gardens, Artillery Row, Westminster. Application date, October 2, 1918.

Means are provided for cleaning the filtering material, *e.g.*, sand, in a mechanical filter. The filter 1 is provided with filtrate discharge pipe 2, which discharges through valve 3 into pressure main 16. When the filter is to be cleaned the valves 3 and 14 are



131,198

closed and the valve 10 opened, so that the pressure liquid passes into the air vessel 4 and compresses the air in it. The compressed air is then passed downward through the pipe 11 and valve 15 through the filtering material in reverse direction to loosen the dirt, and liquid then passes by gravity from the vessel 4 through the filtering material to wash away the loosened dirt. Two or more such filters may be used in combination, and the air compressed in one is used for cleaning the filtering material in another. An improved nozzle is described which is embedded in the filtering material to collect the filtrate and admit the cleaning air and liquid. The nozzle consists of an inverted cone, the flat top of which is provided with small perforations.

International Specifications Open to Inspection

Latest Notifications.

132,229. Resin, Manufacture of. Koppers Co. September 6, 1918.

132,232. Electric Furnace. E. Piquerez. September 2, 1918.

132,256. Liquids, Process of Evaporating. G. A. Krause. July 11, 1917.

132,269. Suction Gas Generators. W. E. Scrivner. September 6, 1918.

Specifications Accepted, with Date of Application

124,732. Liquids, Process for Concentrating or Evaporating. P. E. Matter. March 28, 1918.

131,321. Oxygen and Nitrogen from Atmospheric Air, Process and Apparatus for producing chemically pure. E. Barbet et Fils et Cie. January 31, 1917.

131,328. Hydrogen, Manufacture of. E. K. Rideal and H. S. Taylor. April 30, 1918.

131,334. Nitric Anhydride, Manufacture of. F. Gros et Bouchardy. May 16, 1917.

131,335. Nitric Acid, Manufacture of Concentrated. F. Gros et Bouchardy. June 2, 1917.

131,336. Nitric Acid, Manufacture of. F. Gros et Bouchardy. June 16, 1917.

131,344. Gases from Liquids, Electrically-heated Apparatus for evolving. B. G. Cooper and E. A. Griffiths. May 4, 1918.

131,346. Liquid Mixtures, Separation of. E. A. Cunningham. May 4, 1918.

131,357. Cellulose Acetate, Manufacture of. J. Radcliffe. May 16, 1918.

131,358. Ammonium Nitrate, Production of. A. C. D. Rivett. May 16, 1918.

131,365. Oils and other like Liquids, Apparatus for Distilling the lower boiling constituents from. E. Whittaker. May 21, 1918.

131,399. Acetic Anhydride and Acetaldehyde, Production of. Soc. Chimique des Usines du Rhone (anciennement Gilliard, P. Monnet, et Cartier). June 22, 1917.

131,409. Coal, Distillation of. H. J. Toogood and Dempster & Sons. July 16, 1918.

131,459. Producer or Suction Gas Generators, etc., Gas and Air Mixing Apparatus for. Sharp & Preston, and A. Docking. August 24, 1918.

131,502. Glover Towers and similar Apparatus, Filling Material for use in, and means for producing same. P. Kestner. October 18, 1918.

131,512. Sulphur Dioxide, Process for the Manufacture of Pure. British Dyes, Ltd., J. Turner, and W. B. Davidson. November 1, 1918.

131,516. Crucible Furnaces. F. S. Wigley. November 8, 1918.

The Bengal Iron and Steel Co., (Ltd.)

At the ordinary general meeting of the Bengal Iron and Steel Company, Mr. William Turner MacLellan, C.B.E. (the Chairman and Managing Director), in moving the adoption of the report said the profit for the last year was very much in excess of anything they had previously achieved, and they had put aside £167,000 towards the revenue of the country. "This year is," Mr. MacLellan stated, "the first in which this company has derived any material benefit from the existing state of trade, and a part of the good result is due to the profit made in the manufacture of ferro-manganese—a profit which is not likely to recur, but, on the other hand, the results from our general trade are improving, and we have in hand considerable extensions, both to our blast-furnace plant and to our coke-oven plant, and in about a year's time hope to increase our output of pig-iron about 40 per cent., and we also hope that in the future our contribution to the national revenue will be somewhat less than it was last year. We have recently taken an interest in a brick works, which has now started operations, and which will provide us with firebrick, much of which we had formerly to import from this country at considerable cost. Negotiations are also in hand for the starting of industries in India which will consume a considerable portion of our output of pig-iron, and in these new industries we are taking a substantial interest.

"The balance sheet does not show any marked difference from those of previous years, the principal alterations being the inclusion of the converted founders' shares, which in this year rank for dividend, and also the increased amount placed to renewal and depreciation account. Your directors have, for some time, felt that the arrangement of the capital is not quite on a line with the assets and position of the company, and they have under consideration a scheme which they expect shortly to put before the shareholders involving the reconstruction of the company and also the provision of the necessary capital for the extensions already in hand and under consideration."

The report and accounts were adopted.

Stocks and Shares

Commercial, Industrial, &c.

	Quotations Sept. 10.	Sept. 17.
Alby United Carbide Factories, Lim., Ord.	$\frac{23}{32}$–$\frac{29}{32}$	$\frac{31}{32}$–$1\frac{3}{32}$
Associated Portland Cement Manufrs. (1900.) Lim., Ord.	9–$9\frac{1}{4}$	$9\frac{5}{16}$–$9\frac{9}{16}$
Bell's United Asbestos Co., Lim., Ord.	$2\frac{1}{16}$–$2\frac{3}{16}$	$2\frac{1}{8}$–$2\frac{1}{4}$
Bleachers' Association, Lim., Ord.	$1\frac{1}{2}$–$1\frac{9}{16}$	$1\frac{1}{2}$–$1\frac{9}{16}$
Borax Consolidated, Lim., Prefd. Ord.	$4\frac{1}{2}$–5	$4\frac{1}{2}$–5
Bradford Dyers' Assoc. Lim., Ord.	$2\frac{1}{4}$–$2\frac{3}{8}$xd	$2\frac{1}{4}$–$2\frac{3}{8}$
British Aluminium Co., Lim., Ord.	$1\frac{19}{32}$–$1\frac{23}{32}$	$1\frac{5}{8}$–$1\frac{3}{4}$
British Oil and Cake Mills, Lim., Ord.	$2\frac{1}{4}$–$2\frac{5}{16}$	$2\frac{13}{32}$–$2\frac{15}{16}$
British Portland Cement Manufrs., Lim., Ord.	33/0–35/0	33/0–35/0
Brunner, Mond & Co., Lim., Ord.	40/6–41/6	$2\frac{1}{8}$–$2\frac{1}{4}$
Castner-Kellner Alkali Co., Lim.	$2\frac{5}{8}$–$2\frac{7}{8}$	$2\frac{5}{8}$–$2\frac{7}{8}$
China Clay Corporation, Lim., Ord.	$\frac{1}{4}$–$\frac{3}{8}$	$\frac{1}{4}$–$\frac{3}{8}$
Cook (Edward) & Co., Lim., 4% 1st Mort. Deb. Stock Red.	57–61	57–61
Courtaulds, Lim.	10–$10\frac{1}{2}$	$10\frac{3}{4}$–$11\frac{1}{4}$
Crosfield (Joseph) & Sons, Lim., Cum. 6% Prefce.	$\frac{15}{16}$–$1\frac{1}{16}$	$\frac{15}{16}$–$1\frac{1}{16}$
Curtis's & Harvey, Lim.	$2\frac{9}{16}$–$2\frac{13}{16}$	$2\frac{9}{16}$–$2\frac{13}{16}$
Electro Bleach and By-Products, Ltd., 7% Pref.	xd	.. ..
Explosives Trades, Lim., Ord.	20/6–21/6	20/6–21/6
Field (J. C & J.), Lim., Ord.	$\frac{7}{16}$–$\frac{9}{16}$	$\frac{7}{16}$–$\frac{9}{16}$
Greenwich Inlaid Linoleum (Fredk Walton's New Patents) Co., Lim., Ord.	$\frac{1}{2}$–$\frac{5}{8}$	$\frac{1}{2}$–$\frac{5}{8}$
Harrisons & Crosfield, Lim., 10% Cum. Prefd. Ord.	$1\frac{11}{32}$–$1\frac{15}{32}$	$1\frac{11}{32}$–$1\frac{15}{32}$
India Rubber, Gutta Percha and Tel. Wks. Co., Lim., Ord.	$16\frac{1}{2}$–$17\frac{1}{2}$	$16\frac{1}{2}$–$17\frac{1}{2}$
Lawes' Chemical Manure Co., Lim., Ord.	$5\frac{3}{4}$–$6\frac{1}{4}$	$5\frac{3}{4}$–$6\frac{1}{4}$
Lever Bros., Lim., 6 % Cum. "A" Pref.	$19/7\frac{1}{2}$–$20/1\frac{1}{2}$	19/6–20/0
Do. $6\frac{1}{2}$ % Cum. "B" Pref.	$19/10\frac{1}{2}$ $20/4\frac{1}{2}$	$19/10\frac{1}{2}$ $20/4\frac{1}{2}$
Magadi Soda Co., Lim., Ord.	$1\frac{1}{32}$–$1\frac{5}{32}$	$\frac{7}{8}$–1
Manganese Bronze and Brass Co., Lim., Ord.	$\frac{11}{16}$–$\frac{13}{16}$	$\frac{11}{16}$–$\frac{13}{16}$
Maypole Dairy Co., Lim., Defd. Ord.	$\frac{27}{32}$–$\frac{29}{32}$	$\frac{13}{16}$–$\frac{7}{8}$
Mond Nickel Co., Lim., 7% Cum. Pref.	1–$1\frac{1}{8}$	1–$1\frac{1}{8}$
Do. 7% Non. Cum. Pref.	$\frac{15}{16}$–$1\frac{1}{16}$	$\frac{15}{16}$–$1\frac{1}{16}$
Pacific Phosphate Co., Lim., Ord.	5–$5\frac{1}{4}$	$4\frac{7}{8}$–$5\frac{1}{8}$
Power-Gas Corporation, Lim., Ord.	$\frac{3}{4}$–$\frac{7}{8}$	$\frac{3}{4}$–$\frac{7}{8}$
Price's Patent Candle Co., Lim.	70–80	80–90
Salt Union, Lim., Ord.	$1\frac{3}{8}$–$1\frac{1}{2}$	$1\frac{13}{32}$–$1\frac{17}{32}$
United Alkali Co., Lim., Ord.	$1\frac{1}{4}$–$1\frac{1}{2}$	$1\frac{1}{4}$–$1\frac{1}{2}$xd
Val de Travers Asphalte Paving Co., Lim.	$\frac{31}{32}$–$1\frac{3}{32}$	1–$1\frac{1}{8}$
Van den Berghs, Lim., Ord.	$3\frac{7}{16}$–$3\frac{11}{16}$	$3\frac{9}{16}$–$3\frac{13}{16}$
Walkers, Parker & Co., Lim.	$1\frac{3}{16}$–$1\frac{5}{16}$	$1\frac{3}{16}$–$1\frac{5}{16}$
Welsbach Light Co., Lim.	$2\frac{1}{8}$–$2\frac{3}{8}$	$2\frac{1}{8}$–$2\frac{3}{8}$

Gas, Iron, Coal and Steel

Armstrong (Sir W. G.) Whitworth, Ltd., Ord.	37/6–38/6	37/0–38/0
Ebbw Vale Steel, Iron & Coal Co., Lim., Ord.	$1\frac{3}{16}$–$1\frac{1}{4}$	$1\frac{7}{32}$–$1\frac{9}{32}$
Gas Light and Coke Co., Ordinary Stock (4% Stand.)	58–61	58–61
Hadfield's, Limited, Ordinary	39/6–40/6	38/ –49/0
South Metropolitan Gas Co., Ordinary (4% Stand.)	59–62	59/0–62/0
Staveley Coal & Iron Co., Lim., Ord.	$1\frac{13}{16}$–$1\frac{15}{16}$	$1\frac{13}{16}$–$1\frac{15}{16}$
Vickers, Limited, Ordinary	35/6–36/6	35/0–36/0

Mines, Nitrate, &c.

Anglo-Chilian Nitrate and Rly. Co., Ltd., Ord.	13–14	$13\frac{1}{2}$–$14\frac{1}{2}$
Antofagasta Nitrate Co. Compañia de Salitres de Antofagasta) $5\frac{1}{2}$% 1st. Mt. Debs. Red.	88–93	88–93
Lagunas Nitrate Co., Lim.	1–$1\frac{1}{4}$	1–$1\frac{1}{4}$
Rio Tinto Co., Lim., Ord. (Bearer)	54–55	50–52
Tarapaca and Tocopilla Nitrate Co., Lim.	14/0–16/0	15/6–16/6

Oil and Rubber

Anglo-Java Rubber & Produce Co., Lim.	7/3–8/9	7/0–7/6
Anglo-Maikop Corporation, Ltd., Ord.	5/0–6/0	6/3–7/3
Anglo-Malay Rubber Co., Lim.	$14/7\frac{1}{2}$–$15/1\frac{1}{2}$	$14/1\frac{1}{2}$–$14/7\frac{1}{2}$
Anglo-Persian Oil Co., Lim., Cum. 6 % Part.	$1\frac{9}{32}$–$1\frac{11}{32}$	$1\frac{9}{32}$–$1\frac{11}{32}$
Burmah Oil Co. Ltd., Ord.	$13\frac{7}{8}$–$14\frac{1}{8}$	$14\frac{1}{4}$–$14\frac{1}{2}$
Chersonese (F.M.S.) Estates, Lim.	$4/1\frac{1}{2}$–$4/4\frac{1}{2}$	$4/1\frac{1}{2}$–$4/4\frac{1}{2}$
Mexican Eagle Oil Co., Lim. (Cia Mexicana de Pet. "El Aguila" S.A.) Ordinary	$8\frac{23}{32}$–$8\frac{25}{32}$	$9\frac{3}{8}$–$9\frac{9}{16}$
"Shell" Transport and Trading Co., Lim., Ord.	$8\frac{7}{8}$–9	$9\frac{1}{8}$–$9\frac{1}{4}$
Do. 5% Cum. Pref.	$9\frac{3}{8}$–$9\frac{5}{8}$	$9\frac{3}{8}$–$9\frac{5}{8}$

Company News

AMERICAN CYANAMIDE COMPANY.—Net profits for the year ended June 30 were 1,048,752 dol., after providing for war taxes and other charges; and 1,391,285 dol. was brought forward. Arrears of dividends on the Preferred stock up to June 30, 1918, have been paid; leaving 1,723,529 dol. to carry forward.

BRITISH ALUMINIUM.—Dividend at the rate of 8 per cent. per annum, less tax on the Ordinary shares for six months ended June 30, to be paid on October 1.

BRITISH PORTLAND CEMENT MANUFACTURERS.—The report for the year ended April 30, states that the balance brought forward was £87,722, and the revenue for the year amounted to £345,374, against £328,889; charged to Debenture stock redemption account £16,721, general depreciation reserve account £75,000, against £50,000; dividend on the Ordinary share of 8 per cent. per annum for the year, against 6 per cent.; forward £91,509. The production of cement during the year showed a moderate increase, improved facilities for obtaining labour being granted when the Government was pressing for increased deliveries of cement. The desirability in the interest of the shareholders of closer working with the Associated Portland Cement Manufacturers (which holds a controlling interest in the Ordinary share capital of the British company) has been recognised by the boards of both companies, who have adopted a scheme of joint management. Each of the existing £10 Preference shares are to be divided into 10 £1 shares.

CALIFORNIA PETROLEUM CORPORATION.—Regular quarterly dividend of 1¾ per cent. on Preferred stock and 2½ per cent. balance of back dividends on the Preferred stocks, both payable on October 1.

CHINO COPPER CO.—Capital distribution 75 cents, payable September 30, to stockholders of record, September 16.

DOMINION STEEL.—The directors have declared a dividend at the rate of 1½ per cent. on the Common shares, payable October 1 to holders of record September 5. Holders of warrants to bearer are notified that Coupon No. 22 will be paid on and after October 1, on presentation at the Bank of Montreal, London, or in Montreal.

ELLIOTT'S METAL CO.—The net profits of Elliott's Metal Co. for the year ended July 31 were £64,051, after providing for debenture interest and excess profits duty, and £28,902 was brought forward. A final dividend of 2s. per share is proposed on the Ordinary shares, making 3s. per share (15 per cent.) for the twelve months, adding £20,000 to the reserve (making that fund £110,000), writing £2,500 off issue expenses, and carrying forward £21,371.

INTERNATIONAL LIGHT AND POWER CO., LTD.—A dividend of 1½ per cent. ($1.50 per share), less British income-tax, has been declared upon the Preference shares for the quarter ending September 30, 1919; and the same will be payable in London on October 1, 1919, to shareholders of record September 16 on Canadian register. Preference certificates registered in the name of the Municipal and General Securities Co., Ltd., may now be presented for marking at the London office of the company.

KERN RIVER OILFIELDS OF CALIFORNIA.—Final dividend for the year ended May 31 of 11 per cent., less tax, making with the interim dividend 15 per cent. for the year, against 10 per cent. for the previous year. It is the intention of the directors to offer shareholders Ordinary shares in the ratio of one new share for every complete five shares at present held at the price of 15s. per share.

LAWES' CHEMICAL MANURE.—The report to June 30 last states that a settlement with the Inland Revenue authorities in respect of the two years ended June 30, 1917 and 1918, respectively, having been reached, the customary accounts for those years are now submitted. Interim dividends of 7 per cent. on the Preference shares and 7s. 6d. per share on the Ordinary shares have been declared and paid for 1917, and 7 per cent. on the Preference shares and 10s. per share on the Ordinary shares for 1918, all subject to tax. The accounts for the year to June 30 last show an available sum (including balance from previous year) of £309,30. The directors recommend payment of a dividend of 7 per cent. on the Preference shares, less tax, £5,372; dividend of 10s. per share and a bonus of 2s. 6d. per share on the Ordinary shares, both less tax, £15,746; to reserve for bad and doubtful debts, £300; carried forward, £9,512. A sum of £6,700 for depreciation has been written off in the accounts for the year.

MAJOR & CO.—For the year 1918 the profit of Major & Co., coal-tar distillers, &c., of Sculcoates, Hull, increased £3,200, to £24,447, more than recovering the set-back of 1917. The allocations for depreciation and to reserve are again to be £3,500 and £5,000 respectively, and the Preferred Ordinary dividend, which was raised from 5 to 10 per cent. a year ago, is to be repeated, leaving £11,832, as against £7,635, to be carried forward. The report states that the directors had hoped that the question of excess profits duty would have been settled before presenting the accounts, but the sum carried forward will be more than sufficient to meet the assessment. Since the last meeting, the capital of the company has been increased by the issue of further Preferred shares, which will participate in dividends as from June 1 of this year, and the whole of this class of shares has been made cumulative. The number of cumulative Preferred shares now issued is 155,000. The five-and-a-half per cent. second mortgage debentures have now been redeemed.

MALANG RUBBER ESTATES.—The accounts for 1918 show a profit of £10,440, against £9,875; to writing down preliminary expenses and underwriting and brokerage, £1,279. Dividend of 12½ per cent., less tax; forward, £4,637, against £6,051. For 1917 5 per cent. was paid.

MAGADI SODA CO.—The profit and loss account for 1918 shows a debit balance of £48,954, increasing the debit balance brought in from 1917 to £100,89[illegible]. The report states that the sales of the company's products increased at the beginning of the year under review, but the cessation of hostilities and consequent release of soda ash for commercial purposes seriously affected the sales of the company's granular soda. Native wages increased to an unprecedented extent, as also did the cost of all material, and this made the hand-winning of the soda uneconomical. The company therefore decided about the middle of this year to discontinue production and devote all its energies to the completion of the mechanical winning and transporting plant. The company's claim against the Government for compensation for the use of the former's railway and water supply by the military authorities in East Africa has been repudiated, and at present remains unsettled. The military authorities are still in occupation of the company's Irlam Works, near Manchester, but no payment of rent has yet been made to the company.

NEVADA CONSOLIDATED COPPER CO.—Capital distribution 37½ cents, payable September 30.

OBAN AND AULTMORE-GLENLIVET DISTILLERIES.—For the year to June 30 last the profits amounted to £8,427; £1,926 was brought in, making £10,353. After deducting preference dividend for half-year of December 31 last, less tax, there is left £9,569. The directors propose to place to depreciation, £500; to reserve, £4,000 (making £16,000); pay a dividend on the Preference shares at 5 per cent. for the half-year to June 30, less tax at 6s. in the £; and a dividend of 5 per cent. on the Ordinary shares, less tax; also additional dividends for the year on the Preference and Ordinary shares at 2s. per share, less tax; carrying forward, £2,581.

PERAK RUBBER PLANTATIONS.—The net profit for the year ended March 31, after allowing £500 for depreciation, was £4,105, against £21,964. Dividend of 1½d. per share, free of tax, equivalent to a total dividend of 8.93 per cent. (less tax at 6s. in the £); forward, £12,908, against £15,005. For the previous year, the dividend was 4d. a share, tax free.

RAY CONSOLIDATED COPPER CO.—Capital distribution 50 cents, payable September 30.

SCOTTISH OILS (LIMITED).—Scottish Oils (Limited), has now been registered at Edinburgh to give effect to the arrangement made with the Anglo-Persian Oil Co. for the amalgamation of several leading Scottish companies. The capital of the new company is £4,000,000. The company will acquire the Ordinary shares of the Pumpherston Oil Co., the Broxburn Oil Co., the Oakbank Oil Co., Young's Paraffin Light and Mineral Oil Co., James Ross and Co., Philpstoun Oil Works, and also the goodwill, so far as it relates to Scotland, of the British Petroleum Co. and the Home Light Oil Co. Control of the new company will be in the hands of the Anglo-Persian Oil Co., and important developments are expected.

SHEEPBRIDGE COAL AND IRON CO.—For the year to June 30 last, the net profits amount to £156,602, against £176,724 for the previous twelve months. A balance dividend of 5 per cent. is recommended, making 10 per cent., tax free, for the year, against 12½ per cent. for the previous year; £50,000 is placed to reserve and £33,374 carried forward. Last year, £50,000 was allocated to development of new properties and £23,892 carried forward. Provision has been made in the accounts to meet the company's liabilities for Government taxation. In accordance with the special resolutions passed by the shareholders on December 30, 1918, and confirmed on January 16, 1919, the nominal capital has been increased by the creation of 500,000 new Ordinary shares of £1 each, of which 334,631 shares have been allotted as fully paid to the shareholders in proportion to their holdings.

TIN FIELDS OF NORTHERN NIGERIA.—The report for the year ended March 31 states that the total quantity of tin concentrates won was 118.3 tons, against 132 tons, which realised (after allowing for smelting charges) £17,084, at a total cost of £11,101, excluding London office expenses. The balance brought forward was £8,42[illegible], to which has to be added £2,956, the net profit for the year, making £11,381. Dividends of 10 per cent. and 5 per cent. respectively have been paid (less tax), which absorbed £7,700, leaving a balance to be carried forward, subject to income-tax, of £3,680.

THE UNITED INDIGO AND CHEMICAL CO.—Profits for the past financial year amounted to £50,272, to which must be added £29,055 brought forward. The sum of £14,000 is set aside to meet the estimated liability to excess profits. Final dividends of 17½ per cent. (actual) on the Ordinary, making 20 per cent. for the year, and a final dividend of 15 per cent. (actual) on the patricipating Preference, making 20 per cent. for the year, are declared. A special bonus to the directors absorbs £3,002, leaving to be carried forward £43,325. The distribution is the same as a year ago.

UNITED GLASS BOTTLE MANUFACTURERS.—The directors have declared an interim dividend at the rate of 10 per cent. per annum for the half year, less tax, on the old Ordinary shares.

UTAH COPPER CO.—Capital distribution $1.50, payable September 30, to stockholders of record, September 16.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

LONDON GAZETTE

Partnership Dissolved

CROOKE, Reginald, deceased, and CROOKE, Norman, oil and produce brokers, 11, Dale Street, Liverpool, under the style of R. Crooke, Junior and Co., as from June 30th. The business will in future be carried on under the same style by Frederick Graham, by whom the liabilities of the late partnership will be discharged.

Liquidators' Notices

BERMONDSEY GLASSWORKS LTD.—A general meeting of members will be held at 31, Copthall Avenue, London, on Tuesday, October 21 at 12 noon. W. E. Fordham, Liquidator.

TRINIDAD OIL & TRANSPORT CO., LTD. (In Liquidation).—A general meeting will be held in the committee room of the Chartered Institute of Secretaries, 59a, London Wall, E.C.2., on Thursday, at 2.30 p.m. A. O. Chudleigh, Liquidator.

ALADDIN COBALT LTD. (In Liquidation).—A meeting of creditors will be held at 638, Salisbury House, London, on Wednesday, September 24, 1919, at 11 a.m. F. F. Fuller and R. Simpson, Liquidators.

RE SOUTHERN CALIFORNIAN OIL SYNDICATE LTD. (In Voluntary Liquidation).—A meeting of creditors will be held at 3, Gerrard Street, London, W., on Monday, September 29, at 3 p.m. M. H. Adams, Liquidator.

THE COPAL VARNISH CO., LTD. (In Voluntary Liquidation).—A meeting of creditors was held at Sherwood House, Piccadilly Circus, London, W., on Thursday, September 18, at 12 noon. Joseph S. Walker, Liquidator.

THE SAN ANTONIO IRON ORE CO., LTD. (In Voluntary Liquidation).—A general meeting of members will be held at the registered office of the company, Basildon House, Moorgate Street, London, E.C., on Monday, October 13, at 12 noon. Frederick W. Frigout, Liquidator.

Companies Winding up Voluntarily

RUBEL BRONZE & METAL CO., LTD.—Sir Harry Seymour Foster, 82, Victoria Street, London, S.W.1, appointed Liquidator.

LYMN CHEMICAL ENGINEERING CO., LTD.—Mr. Frederick William Stephens, 26-30, Salisbury House, London Wall, London, Incorporated Accountant, appointed Liquidator.

RE SOUTHERN CALIFORNIAN OIL SYNDICATE LTD.—Mr. Matthew Henry Adams, 3, Gerrard Street, W.1., appointed Liquidator.

KINGSTHORPE LEATHER MANUFACTURING CO., LTD.—Mr. Harry Claude Palmer (Messrs. A. C. Palmer & Co.), Chartered Accountant, appointed Liquidator.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, created after July 1st, 1908, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges which would, if created after July 1, 1908, require registration. The following Mortgages and Charges have been so registered. In each case the total debt, as specified, in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced since such date.*]

ASTRA CHEMICAL CO., LTD., LONDON, W.C.—Registered September 3, memorandum of deposit for securing all moneys due or to become due, to the London Joint City and Midland Bank, Ltd.; charged on freehold land and buildings at Elmers End (Croydon Road), Kent. *——. December 31, 1918.

BRITISH FIBROCEMENT WORKS, LTD., ERITH.—Registered September 4, £55,000 first debentures and £40,000 second debentures; charged on freehold land and hereditaments at Erith, also a general charge.

ELSTREE CHEMICAL WORKS, LTD., LONDON, E.C.—Registered September 9, £2,000 debentures, part of £15,000; general charge.

SAFETY CELLULOID CO., LTD., WILLESDEN.—Registered September 9, £10,000 debentures; general charge. *£7,000. March 5, 1919.

Satisfactions

CROYDON FILM CO., LTD., CROYDON.—Satisfaction registered September 5, £600, registered January 29, 1917.

SAFETY CELLULOID CO., LTD., WILLESDEN.—Satisfaction registered September 9, £7,000, registered February 3, 1919.

PLATE GLASS AND SILICATE MARBLE CO., LTD., DUBLIN.—Satisfaction registered September 6, £1,000, registered January 10, 1905.

New Companies Registered

ANTIKOH, LTD.—To acquire and carry on the business of alkali acid and waterproof fabrics, &c. Nominal capital, £10,000 in 3,000 preference shares of £1 each and 7,000 ordinary shares of £1 each. Directors: E. W. Adams, 108, Canterbury Road, Old Kent Road, S.E. 15; G. Betson, 52, Hurley Road, Lower Kennington Lane, S.E. 11; C. Hayes; W. J. Adams. Qualification of Directors, 100 ordinary shares; 200 ordinary shares per director. Remuneration of Directors, £50 each.

BASIC FERTILIZERS, LTD., 20, Copthall Avenue, E.C. 2.—Manufacturers of all kinds of chemical fertilizers. Nominal capital £30,000 in 30,000 shares of £1 each. Directors: H. G. K. Palmer, The Hall, Johnston, Pembrokeshire; G. Jones, "Southernwood," Christchurch Road, Newport, Mon. Qualification of Directors, £250. Remuneration of Directors, £200 to be divided.

BRITISH TANNERS, LTD., 25, Lord Street, Liverpool.—To acquire and distribute hides and skins, and carry on the business of tanners, curriers, &c. Nominal capital, £500,000 in 500,000 shares of £1 each. Directors: W. E. Walker, Lever Grange, Bolton (Chairman); A. Appleton, Rostherne, Litherland, Liverpool; H. P. Densham, Cuerdon Hall, Thelwell, Nr. Warrington. Qualification of Directors, 1,000 ordinary shares.

EBO-RUBBER, LTD., "A" Warehouse, 3rd Section, Seal Wharf, Stratford, E.—India-rubber manufacturers, and makers of articles made or prepared with india-rubber. Nominal capital £3,000 in 3,000 shares of £1 each. Directors: G. Cowap (Managing Director), J. Noone, W. A. Cox. Qualification of Directors, one share.

EMPIRE (ALLOY) STEEL CORPORATION, LTD., 62, Pall Mall, S.W. 1.—Manufacturers of high-grade steels, or alloys of steel or other metals, engineers, &c. Nominal capital: £250,000 in 250,000 shares of £1 each. Directors: D. C. Lee, 1, Dr. Johnson's Buildings, Temple, W.C.; Lieut.-Com. W. B. Ballentine, 62, Pall Mall, S.W. 1. Qualification of Directors, £1,000. Remuneration of Directors, Life Directors by agreement; others, £500 each.

C. F. GERHARDT, LTD., 5, Fenchurch Street, E.C.—Importers, exporters and dealers in drugs, chemicals, drysalteries, minerals and produce of all kinds. Nominal capital £30,000 in 12,000 7 per cent. cumulative preference shares and 18,000 ordinary shares of £1 each. Directors: C. F. E. Gerhardt, "Woolley's," Hambleden, Henley-on-Thames; C. G. J. Gerhardt, "Woolley's" Hambleden, Henley-on-Thames; C. E. Alexander, "Ivinghoe," Hendon Avenue, N.3. Qualification of Directors, £100. Remuneration of Directors, £50 each.

HAYS MARINE WATERPROOF GLUE CO., LTD.—Manufacturers and dealers in marine glue, paint and varnish. Nominal capital £6,000 in 600 shares of £10 each. Directors: C. H. House, "Privett Place," Alverstoke, Gosport; P. J. House, "Privett Place," Alverstoke, Gosport. Qualification of Directors, 20 shares.

HEADS (WHITWORTH), LTD., 465, Market Street, Whitworth, Nr. Rochdale.—Chemists and druggists. Nominal capital £500 in 500 shares of £1 each. Directors: W. Bamford, 67, Palatine Terrace, Norden, Nr. Rochdale; H. Bamford, 127, Peel Street, Rochdale; W. Bamford, Jnr., 67, Palatine Terrace, Norden. Qualification of Directors, £50.

INSULATORS, LTD.—Manufacturers of insulating materials, chemical materials, and products of all descriptions. Nominal capital £75,000 in 75,000 shares of £1 each. Minimum subscription 7 shares. Directors: to be appointed by subscribers. Remuneration of Directors, £250 each. Chairman, £300. Subscribers: S. M. Goddard, 51, Corinne Road, Tufnell Park, N. 19; B. C. Sparks, 116, Elgin Avenue, Maida Vale, W. 9; A. N. Stockdale, 20, Lawrence Lane, E.C. 2.

J. T. MEREDITH (CARBONISER), LTD., Calder Works, Elland, York.—Carbonisers, dyers, finishers, bleachers, &c. Nominal capital £10,000 in 10,000 shares of £1 each. Directors: To be appointed by Subscribers. Qualification of Directors, £100.

OPENSHAW'S PHARMACY, LTD., 41, Winter Hey Lane, Horwich, Lancaster.—Chemists and druggists. Nominal capital £1,000 in 1,000 shares of £1 each. Directors: R. Openshaw; Esther Openshaw. Qualification of Directors, 1 share.

SAN SALVADOR SPANISH IRON ORE CO. (1919), LTD., 80, Bishopsgate, E.C. 2.—To acquire ironstone mines and carry on the business of mine owners, &c. Nominal capital £126,000 in 126,000 shares of £1 each. Minimum subscription, 7 shares. Directors: C. S. Quartermaine, Royal Automobile Club, Pall Mall, S.W. 1.; N. Goldman, 96, Ridgmont Gardens, W.C. 1; G. Ainsworth, Consett Hall, Consett, Co. Durham; Sir J. Backhouse Dale, Bart., 8, Sussex Square, W. 2. Qualification of Directors, £100. Remuneration of Directors, £130 each; Chairman, £200.

SHAWINIGAN, LTD., 1, Tudor Street, E.C.—To manufacture and mineral metallic and electro-chemical substances of every description and carry on the business of manufacturing chemists. Nominal capital £10,000 in 10,000 shares of £1 each. Directors: To be appointed by subscribers. Qualification of Directors, £1.

SWINTON FINISHING CO., LTD.—Finishers, stiffeners, calenderers, dyers, &c. Nominal capital £6,000 in 6,000 shares of £1 each. Directors: B. Britton, 307, Holcombe Road, Greenmount, Bury; A. Fogg, 60, Nopper Lane, Whitfield; L. B. Midgley, Brackley House, Folly Lane, Swinton; W. K. Ridsdale, 18, Lancaster Place, Blackburn; and two others. Active Directors. Qualification of Directors, £50. Remuneration of Directors, £50 to be divided. Active Directors, £5 per week each.

TANNERS SUPPLY CO., LTD., 150, Boundary Street, Liverpool.—Tanners and tanners' suppliers. Nominal capital £5,000 in 2,000 ordinary shares of £1 and 3,000 preference shares of £1. Directors: J. S. Longshaw, 150, Boundary Street, Liverpool; Sarah A. Longshaw, 61, Church Street, Egremont, Chester. Qualification of Directors, £100.

WESTERN TABLET CO., LTD.—Manufacturing and dispensing chemists. Nominal capital £10,000 in 10,000 shares of £1 each. Directors: P. Barrs, 33, Lancaster Park, Richmond; E. P. Taylor, 24, Alcestic Road, Moseley, Birmingham; G. H. Maile. Qualification of Directors, £100.

The Affairs of J. Mackenzie O'Brien

The public examination of J. Mackenzie O'Brien, 10, Rydal Road, Streatham, Surrey, took place on September 11, at the Court House, Wandsworth. His statement of affairs showed liabilities of £13,726 9s. 8d. and assets of £4,775 9s. 11d. The debtor stated, that he came to England in 1893, having previously been dealing in patents in America. He started certain inventions here, one of which was a flashlight sign. In 1899 he was adjudicated bankrupt at Manchester, no dividend being paid. In October, 1909, he went to Paris and took out a patent for a Bull-Dog tyre. These tyres were manufactured there by a firm from whom he received about £10 a week for sales. Requiring £10 for a purpose he borrowed this amount on his rights in the patent and never received his rights back. His English rights of the Bull Dog tyre patent he sold to his wife for £7. In December, 1916, he took out a patent for a petrol substitute, and under an agreement h let a company have the sole rights to manufacture, for which he was to receive a royalty of 3d. per gallon. The company gave him £60 a month, the minimum guarantee, and he received £10 a week as technical adviser. In May last year, he borrowed £900 because he was hard up and wanted to pay various debts, and in January he granted an option for the purchase of the patent for £5,000. The option, the debtor said, would not be exercised. The debtor stated that he had a large family, and his living expenses were at the rate of £1,500 a year. He attributed his failure to endorsing bills given to his wife by the Bull Dog Motor Tyre Syndicate in connection with the sale by her to the Syndicate of her interest, and for which he received no benefit. The examination was closed.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 4, Queen Anne's Gate Buildings, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

Locality of Firm or Agent.	Materials.	Ref. No.
Czecho-Slovakia..	Chemicals	656
Buenos Aires ..	Chemical Products, Industrial chemicals, Laboratory articles	670
Italy (Turin) ..	Chemical products	660
Italy (Milan) ..	Chemicals and Pharmaceutical Products, paints, varnishes	661
Brazil	Heavy chemicals	672

Contracts Open

SLEAFORD.—(1) Paraffin oil; (2) lubricating oil; (4) disinfectants—(a) fluid, (b) powder, (c) soap; (5) pure lard oil. Particulars from Mr. E. H. Godson, Clerk, Council Offices, Sleaford. Tenders by September 27.

CAMBRIDGE.—Hard soap. Particulars from the Steward, Cambridge County Mental Hospital. Tenders by 12 noon, September 22.

WHITECHAPEL.—(5) Soap; (6) oil. Particulars from Mr. F. J. Tootell, Clerk, Union Offices, 74, Vallance Road, E. 1.

PRACTICAL DYE MEN and Hongkong importers of dyes report that the chief factor in the future of the sale of dyes in China is the standardisation of colour shades. One of the chief elements of the success of German dyes in this field was that certain shades popular among the Chinese could be relied upon. The matter of colour is very important among the Chinese, aside from the comparative beauty. Many of the colours have special significance of a ceremonial sort as well as being regarded more or less lucky or unlucky. There are large interests in China, especially in Amoy, Swatow, Chuchow, and various South China coast cities, where imported shirtings and sheetings are dyed for sale to the Chinese. The basis of this entire business is the quality of the colour in cloths thus handled, which depends on the uniformity of colour and the quality of the dyes.